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Benjamin Franklin.

On January 17 of this week two centuries elapsed since the birth of the greatest American who has yet lived—Benjamin Franklin, the many-sided and myriad-minded, philosopher, statesman, diplomatist, politician, social economist, philanthropist, educator, writer, republican, courtier, wit, man of affairs, inventor, electrician. To commemorate the occasion we print in this issue several articles treating of that part of Franklin's work of more special interest to our readers. The remarkable article by Brother Potamian gives the result of researches made with a view to bringing out all the facts having a bearing on the matter of priority of the celebrated kite and lightning rod experiments. In France the claims for Franklin have been contested, and for a century and a half the controversy at intervals has cropped up. Brother Potamian has made an exhaustive study of contemporary printed records, and his conclusions in favor of Franklin will be difficult to contest, notwithstanding that they rest largely on what may be termed *ex parte* evidence. Franklin himself did not record the circumstances of the kite experiment as actually performed; his biographer and intimate friend, Dr. Stuber, and his friend Priestley, did not offer any independent evidence; his son, an eye witness, who lived until 1813, apparently remained ever silent on the subject and a grandson, of whom Franklin was extremely fond and from early youth kept at his side, contented himself in preparing his great ancestor's works for publication, with quoting the account of the experiment written by Stuber. We set forth these considerations, not to throw doubt on the claims for Franklin, but to mark the singular absence of corroborative evidence in a case where one would expect it to be abundant.

In the article by Dr. Houston an account is given of the several scientific and educational foundations due in part or in whole to Franklin, through which his direct influence extends to to-day and will continue on through ages. The University of Pennsylvania and American Philosophical Society are national in scope and known to all. In this day of lavish library endowment one cannot so well appreciate the importance of the Philadelphia Library foundation, which for more than a century served as an object lesson and model for other cities. When, however, we come to the history of the Philadelphia and Boston legacies, there is a discordant note. Franklin undoubtedly had the fondest hope that these foundations would serve as his greatest monument and his greatest material contribution to posterity. Instead they stand as a warning to others who would confide a similar trust requiring the most cherishing care, to unborn generations. Perhaps the outcome would not have been so lamentable if in his testament Franklin had allowed more latitude in the management of the funds, but as in the case of the Girard foundation, the conditions existing in one generation were unfortunately imposed on succeeding generations. As a writer has recently pointed out, much of the great strength of Franklin lay in his "contemporaneity," but in the case here considered this characteristic proved a weakness. The Philadelphia Franklin fund at the end of a century amounted to only $87,600.29, though some decades previously it had received an addition by legacy from John Scott, the founder of the Franklin Institute John Scott prize and medal. Franklin had calculated that the value of the fund at the end of a century would be $655,000, and in his will

he directed that of this amount $155,000 was to be placed at compound interest for another century, and the final proceeds, which he estimated at $20,000,305, be divided between the citizens of Philadelphia and the Pennsylvania State government. And the end of all this will be—a wing of an art building in Fairmount Park! The fate of the Boston fund was somewhat better, the present value being more than $400,000, which will be increased by Mr. Carnegie, and a "Franklin Union" founded along the lines of Cooper Union of New York City.

The Illuminating Engineering Society.

The organization in New York last week of the Illuminating Engineering Society with an initial membership little short of one hundred and the prospect of an additional enrollment of several hundred names during the next few months, indicates the rapid growth of interest in illumination as an art. While the scientific principles of artificial illumination are well established, until quite recently little systematic attention has been given to their application. The degree of illumination desirable for different purposes, the disposition of light sources for the best effect, artistic or otherwise—these and other points have in the past either been entirely ignored, or lacking exponents, have not been accorded the attention which less important details of lighting work, accepted as within the direct province of the architect and engineer, have received as a matter of course. In many cases recourse has been had for effect to barbaric lavishness of light, and it is rare, even when attempts are made at good illuminating effects, that full consideration is given to the side of the problem involving the physiology of human vision, as those subject to distressing effects on the eye from glare can testify. The new society can accomplish an admirable purpose, both indirectly by giving to illuminating engineering a recognized status, and directly through its papers and discussions by bringing together and co-ordinating the knowledge on the subject now so widely scattered, and extending it by recording data and by furthering the systematization of practice.

Whether the progress of the art of illumination will finally give rise to a distinct profession, or whether the illuminating engineer will remain an electrical engineer or gas engineer, an architect or fixture designer, with illuminating engineering as a specialty, can only be determined by the future. In view of this indefiniteness the Society has acted wisely in declaring its desire to co-operate with, and in no manner antagonize, other bodies which share with it an interest in furthering the economic, effective and artistic use of artificial light. None has a greater interest in these objects than those connected with the lighting department of the electrical industry. The electric light is ideally adapted for producing refinements in illumination of a kind impossible with other sources, and the development too long neglected of its superiority in this respect will be assisted by seconding the purposes and encouraging the work of the Illuminating Engineering Society.

Tentative Theory of the Heusler Magnetic Alloys.

Hitherto, we have not seen any theory suggested for the remarkable behavior of the copper-aluminum-manganese alloys discovered by Heusler about a year ago. The only significant circumstance suggested has been that copper and manganese are the two elements which lie nearest on each side to the group of the magnetic metals, iron, nickel and cobalt, in a table of ascending atomic weights. A tentative theory has, however, been published recently by M. C. E. Guillaume in *L'Industrie Électrique*. It is pointed out that, in general, the melting point of temperature for an alloy is less than that of the component metals. Thus, taking the metals, copper and bismuth, copper melts at 1,050° C., bismuth at 630° C. and alloys of these two metals, in some proportions, melt at a temperature as low as 490° C. Three series of binary alloys have, however, recently been discovered in which this rule is disobeyed. That is to say, the melting point of the bath containing the two metals is higher than that of either component. These alloys are aluminum-gold, aluminum-bismuth, and tin-sodium. It is suggested that, judging from these facts, aluminum and tin may possess the property of raising the temperature of fusion when alloyed with other metals. In other words, if copper be alloyed with a metal, it tends to depress the melting point of the alloy; but if either aluminum or tin be alloyed with a metal, it seems as though they tended the other way, or to raise the melting temperature. It is a curious and, perhaps, a significant circumstance, that the new magnetic alloys are two—namely, aluminum-manganese, and tin-manganese. The first discovered was aluminum-manganese, dissolved in copper in order to increase the malleability or softness of the alloy. The copper is said not to influence the magnetic property except as a mere diluent. The magnetic properties are said to depend wholly upon the amount of manganese-aluminum alloy present in constituent proportions of the formula Mn-Al; i. e. two parts by weight of manganese to one of aluminum. More recently, the tin-manganese magnetic alloy has been discovered, corresponding in proportions to the formula Mn_2Sn.

It is suggested by Mr. Guillaume that manganese is the essentially magnetic element in both these cases, but that this metal loses its magnetic properties at ordinary temperatures. Iron and nickel, perhaps also cobalt, lose their magnetic properties at relatively high temperatures. In iron the loss occurs at about 890° C. and in nickel at about 340° C., although the loss is less complete in the latter. The loss of magnetic properties is attributed to a change in atomic grouping. The melting point signifies also a change in atomic grouping. Above the melting point, the liquid substance is amorphous; while below the melting point the solid substance is crystalline. Now, although the change in grouping which occurs at the melting point is not that which accompanies the loss or gain of magnetic properties, yet they are perhaps associated in some manner. It may be that the property of aluminum and tin seemingly to raise the melting point of the substance with which they are judiciously alloyed is connected with the development of the magnetic properties of manganese.

Inductive Balances in Power Distributing Systems

The tendency of the present time in electrical engineering is clearly to collate the various principles employed in diverse applications, so that the apparatus used in one branch, say telegraphy, becomes adapted to use, under structural modifications, in a very different branch, such as electroplating. An instance of this correlation is presented in the double-wound induction coils generally employed in telephony. These coils are connected across the circuit in such a manner that the two parts coact as a single inductive winding. A tap to ground between the parts places them, however, in mutual opposition, or in the balanced inductive state, so that the inductance of the device is practically nil in this ground-return circuit. Essentially similar apparatus is now being applied to the control of alternating-current distribution circuits. The *Electrician* of London recently described some of these in-

ductive-balance devices, as noted last week in the Digest. A small magnetic circuit is overwound by a pair of similar potential coils and also by one turn of a large conductor or current-carrying main. The potential coils are connected in parallel opposition through a pair of alternating-current relay coils. The potential circuit from the bus-bars thus supplies two like branch circuits in parallel, each branch containing a coil on the small transformer and a coil on the relay. The relay coils pull upon core plungers, and the pull is normally equally strong on both; so that when the plungers are strung on a balance beam, the beam has no tendency to tilt in either direction.

If now the current in the main linked with the magnetic circuit becomes powerful, it applies an m.m.f. to the magnetic circuit and establishes thereby an induced e.m.f. in both the potential coils in the same direction. This e.m.f. sends a current through both the relay coils in series, in such a manner as to strengthen one branch current and weaken the other. The assisted relay coil preponderates in its pull upon its plunger core and tilts the balanced supporting beam, thereby closing the circuit of a switching or tripping coil. This apparatus may be used in a reverse-current cut-out by allowing the working direction of current in the bus-bar to tilt the plunger beam against an insulating stop; but if the generator in circuit with the bus-bar should fail, so that the current backs up from the system into the generator, the plunger beam will tilt in the opposite direction and close the circuit of a tripping coil operating the circuit-breaker of the generator, and cutting it off the system. The apparatus is also used for disconnecting extra transformers from secondary bus-bars at a distant sub-station when the peak of the load has passed. The strength of the method lies in the great power of a relatively small differential m.m.f., when superposed upon a pre-existing stationary m.m.f. in two relay coils. The electromagnetic pull upon the plunger is substantially proportional to the squares of the respective vector resultant m.m.f's. The difference between the squares of the augmented and diminished m.m.f's in the relay coils may readily be many times greater than the squares of differential m.m.f's alone.

ELECTRICAL COMBINATIONS.

The papers which we are now publishing regarding the work of the Public Service Corporation are worth careful study as showing a striking type of the usefulness of judicious combination. In these days of disquieting exposures of the putative just, the very name of combination may call up unpleasant mental images, but the fact is that in the present instance, as in others, there is a physical advantage in combinations which is inevitably shared by the public. It is only when combinations are formed with fundamental reference to their aqueous capacity and without due comprehension of the operative gains, that they properly may be looked at askance. So long as the public gets better or cheaper service, or both, the public ought not to grumble at the consolidation that brings this result. Primarily in the present case the object of consolidation was to prevent needless competition with its inevitable reduplication of service, and thereby to put the various operating companies on a safer financial footing. On the face of things, one may be disposed to think that the abolition of competition implies putting the thumb screw upon the public, and such is sometimes the case. There is, however, a kind of competition which hurts the competitors without helping the public, as every business man knows to his sorrow.

Combinations like the one we are here considering nearly always tend to better service by substituting uniformly good methods for a mixture of good and bad, by dealing with operative problems as a whole instead of in dissociated fragments, and by giving the whole system a financial stability and relieving it from the hand-to-mouth existence that has been the fate of many a small company. Every electrical plant for lighting or for traction has to a greater or less extent been pursuing the policy of capitalizing its blunders, and when this has been accompanied by poor general management, the result has been a constant struggle to make both ends meet. In such cases a consolidation means salvation to the service. Again, through a given territory plants have sprung up responsive to local necessities and have grown with these necessities. Presently their "spheres of influence" touch and more or less costly competition follows, seldom benefiting the consumer to any extent, but injuring the parties to it. Looking at the area as a whole, it is generally evident that the stations are located in the wrong places, the several networks are not so disposed as to help each other, the railway lines do not transfer at the right places, if at all, and the fares are both high and ill adjusted. Now it is possible, as in this case of the Public Service Corporation, for a consolidated company to step in, put the heterogeneous plants into touch with each other, replace the inefficient ones, lay out the feeder system for the whole territory, unify the transportation systems so as to get efficient transfers and through lines, and in general to give better service while itself gaining from lower operating costs and smaller general expense.

The present articles show this process still in its formative period, but yet after much has been accomplished. We are not here concerned with the financial adjustment of the system, which must stand upon its own legs, but with the results as they appeal to the consumer. Of the advantage of welding a group of local distributions into a network there is little need to speak. It secures generally a higher efficiency of security against breakdown, both of lights and traction lines. By generating current on a large scale and distributing it efficiently, the cost can be greatly reduced and the price lowered without injuring the system as an investment. The natural tendency in a small and inefficient station is the policy of small sales and high prices, while if a large system is well administered large sales and lower prices are the rule. A fine example of this is to be found in the recent great extension of telephone business at greatly reduced rates. By this trying to make the instrument a general necessity and putting it within the reach of everyone, the chance of competition is greatly reduced and the system gains enough in financial stability more than to offset the lowering of rates. Such is the really beneficient side of wise consolidation. That some consolidations are not wisely administered or organized cannot be denied, but these will bring their own punishment. It is not sufficient to bring properties under a common ownership, they must be brought under a unified system of management without losing touch with the local interests on which their prosperity depends. We could mention cases in which a central organization has been a dismal failure, merely because it has lost sight of local conditions. But, as in the case in hand, a really progressive management can work wonders in operative economy without in any way losing local support, but rather gaining it. Year by year the economical radius of electrical distribution is lengthening and at each step the advantage of unified control increases. In many regions consolidation is economic salvation.

The Illuminating Engineering Society.

We recently referred to the movement toward the organization of a national society having for its object the advancement and dissemination of knowledge relating to the science and art of illumination. At a meeting held in New York, January 10, the society was formally organized, a constitution and by-laws was adopted, and officers elected. The attendance at the meeting was about 75 and the remarks of the various speakers indicated much enthusiasm on the subject of the new society, its aims and its future. Eighty-nine members were enrolled at the meeting, at which it was decided that all those enrolled prior to February 10 will be called charter members.

According to the constitution, any person interested in the object of the society is eligible for membership, no professional qualifications being necessary. The present membership is distributed among electrical engineers, architects, gas engineers and representatives of the gas and acetylene interests, central station companies, fixture houses, etc. The next meeting will be held Tuesday evening, February 13, at the Hotel Astor, New York City, at which President L. B. Marks will deliver his inaugural address, the subject of which will be the Illuminating Engineering Society and its relation to other bodies, such as the American Institute, American Gas Association, National Electric Light Association, etc. It will be pointed out that one of the purposes of the society will be to co-operate with all other bodies having an interest in securing the best results from the various illuminants. Following is a list of the officers elected:

President, Mr. L. B. Marks; vice-presidents, Dr. C. H. Sharp and Mr. A. A. Pope; managers, Dr. A. H. Elliott, Messrs. W. S. Kellogg, E. C. Brown, F. N. Olcott, W. D'A. Ryan and W. D. Weaver; secretary, Mr. E. L. Elliott; treasurer, V. R. Lansingh.

Applications for membership may be addressed to Mr. E. L. Elliott, secretary, 25 Broad Street, New York. There will be no initiation fee for the first year and the annual dues are $5.

New York Automobile Shows.

Two great automobile shows opened to the public in New York city on Saturday evening, January 13, and will continue until the close of the evening of the 20th. At the Sixth National Automobile Show at Madison Square Garden are displayed all types of cars manufactured by members of the Association of Licensed Automobile Manufacturers operated under the George B. Selden patent; while the exhibit made by the Automobile Club of America in the new 69th Regiment Armory, about a stone's throw distant, is open to all manufacturers not operating under the Selden patent. At the Garden show the main floor is devoted exclusively to gasoline pleasure vehicles, electric and commercial vehicles being displayed in the exhibition hall and basement. A somewhat similar system obtains at the Armory show. At both shows automobile accessories are displayed in the galleries.

The decorations of the shows are extremely successful. The confusing and generally unsatisfactory jumble of decorations which has characterized previous exhibitions is entirely lacking, and a serious effort has been made in both shows to carry out an artistic and uniform decorative scheme. The result is a dignified and effective setting which brings out the exhibits to the best advantage.

At the Garden show the color scheme is white and gold. Staff columns spaced ten feet apart support classic cornices containing signs of each exhibitor. From end to end the roof is hidden by blue cloth through which concealed lights send rays down into the space below. From the upper galleries the same color scheme leads down in terraces to the main floor, banners of white and gold and pilasters and columns being interspersed. The 69th Regiment Armory is tastily embellished with a green and white decoration which harmonizes well with the industrial display.

Few radical departures from previous accepted types are to be found. Four-cylinder cars predominate; but eight, six, five, three, two and one-cylinder cars are also to be found, the latter among the low-priced cars. Most of the engines are water-cooled, but numerous methods of air cooling are also on exhibition. The water-jacket on at least one car is deposited electrically. The engine cylinder is given a thick coating of wax and on this is deposited a laying of copper. The wax is then removed by heating, leaving a water-jacket of copper the proper distance from the cylinders to permit the free passage of the cooling water. Ignition by means of the spark coil and battery still holds its own, but in the higher price cars, magnetos of the low-tension and high-tension type are fast displacing the coil and battery.

While the shows are taken up mostly with gasoline automobiles, there are at least eight electric automobiles shown at the Garden and two at the Armory, the commercial vehicles being for the most part electric. In strong contrast to the marvelously complex mechanism of the gasoline cars is the utter simplicity of the electrically propelled machines; but unfortunately the grouping of the machines does not greatly facilitate comparisons except between gasoline vehicles. Something out of the ordinary is the motor battery wagon loaned by the Ordinance Department of the U. S. Army and exhibited in the Armory show. The wagon is provided with a lathe, forge and necessary equipment for almost any kind of emergency on the battlefield.

The automobile industry can only be partly indexed in such exhibitions, yet there are almost five hundred exhibitors in the combined shows. All records for attendance have been broken.

The New York Central-General Electric Rebate Case.

At Utica, N. Y., on January 10, the New York Central and Delaware & Hudson Railroad Companies were indicted by the United States Grand Jury for giving rebates to the General Electric Company. Both corporations are charged with giving a rebate of 20 cents a ton to the General Electric Company at Schenectady on all shipments of freight, incoming and outgoing. It is asserted that this practice has been in operation ever since the General Electric shops were established at Schenectady, and that it has continued since the enactment of the Elkins law. The interesting feature of the indictment is that apparently no case lies against the General Electric Company. Indeed it is said that the question was referred direct to the Interstate Commerce Commission by the parties themselves, over two years ago, when a ruling was asked for, but no adverse decision was made.

Albert H. Harris, the general attorney of the Central, made this statement of the railroad's position:

"The General Electric Company has paid full tariff rates upon its freight over the Central and the Central, on its part, has paid the General Electric Company, on account of railroad terminal work done by it, an amount not more than sufficient to reimburse it for that expenditure. The company claims that what was done was in no sense the giving of a rebate.

"Before the finding of the indictment, and before the matter was called to the attention of the Federal Grand Jury, the railroad companies gave the Government information as to what was being done, and suggested that if there was any question as to whether this was a violation of the Elkins law, the companies would be very glad to have that question tested by a suit in equity for an injunction, and offered to co-operate with the Attorney-General to that end. Earlier still the matter was discussed with the Interstate Commerce Commission, and an informal request made for a ruling on it, but no action was taken on the request.

"Under the Elkins law a complaint of this nature can be determined in one of two ways—by an indictment or by suit in equity for an injunction. The Central is entirely willing to have the matter reviewed, but it feels, in view of the course which it has taken with the Government, that the matter might better have been tested in a civil action rather than that the aid of the criminal courts should have been invoked. As it is, the Central will submit all the facts to the court upon the trial of the indictment, and a ruling can then be had as to whether anything has been done by it which violates either the letter or the spirit of the law."

Electric Wiring in Indiana.

Frank Daniel, electrical inspector for the Indiana State Board of Underwriters, has just made a report of his inspection of twenty or more of the principal cities of Indiana and from what he discovered the electrical conditions are in imperative need of improvement. Mr. Daniel says the low standard of equipment is due to lack of knowledge and skill on the part of electrical workers. In many instances he found the chief fault was due to honest intentioned but unskilled workmen, to whom the National Electrical Code is unknown. The poor conditions are the outgrowth of a hap-hazard development marked by inharmonious additions and patchwork. In rare cases only have the electrical systems for lighting and power in the cities of Indiana had the advantage of intelligent direction from the start. Mr. Daniel said he found many cases of wiring that are the work of men or boys equipped only with nippers and a screw driver and a desire to become electricians. As a result there are many cases of wiring and electrical installation that are truly "fearfully and wonderfully made." Mr. Daniel, who is an electrical inspector of a technical college education backed by years of experience as an electrical engineer, in his report says:

"I was dumfounded by the many hazardous conditions discovered and often wonder how these faulty systems continue to distribute chained lightning to its appointed tasks with only an occasional outbreak on the part of the mysterious force."

Mr. Daniel says that large sums of money will, of necessity, be expended in Indiana in electrical betterments. Mr. Daniel cited cases where he found wooden rosettes strung like incendiary beads on a run of 80 ft. of weather proof wire which was supported by winding around iron gas cap outlets. This wire was pieced out at the feeding end with three feet of lamp cord which had a maximum capacity of two amperes. This piecing could not have been done safely with anything less than No. 8 wire which has a capacity of 33 amperes, and the lamps should have been in regulation rosettes. In the same store he found in the cashier's office and under a counter a busy fire-spitting motor. The floor under it was thick with grease and pieces of paper were ready to get busy with the first spark that should happen to fall. By all the rules of the game this store should have burned out at least ten times a day.

"I took a wooden fuse box from a millinery store. It controlled the main line carrying all lights in the store. There were fifty of these and the sole protection was the single-pole fuse there shown. All wiring was supported on wooden cleats. Wood rosettes were used and wood base stretcher. The whole equipment was blissfully in violation of the National Code," said he.

Mr. Daniel said the Badger furniture store fire in Indianapolis last month was of electrical origin and emphasizes a number of points for which professional inspectors are contending. Here a 5-hp motor was installed in a house on the roof directly over the elevator shaft. Some sort of a fault existed in the motor which caused the fuse to burn out. Instead of finding the fault and remedying it, the man in charge of the motor finally got tired of replacing fuses and to make himself less trouble put in a fuse large enough to carry the objecting current. This did the work and saved the man further annoyance, but the irritation in the motor coils of mechanism continued, causing the current to seek another avenue of escape. It finally found a weak place in the wire connecting field and armature coils and here it broke bounds and grounded. The sparks resulting fell on the oily floor under the motor and started the fire.

A recent fire in Terre Haute was started from a home-made rheostat, the arm of which was controlled by a rope passing over a window sash, the pulley of which moved the contact arm. The rheostat was constructed of small pieces of broom wire spliced together, the whole being supported in direct contact with a frame partition. Mr. Daniel closes his report by saying that competent electricians are needed. Conditions in Indiana show conclusively that most of the defects in wiring are due to ignorance on the part of local workmen. There is need for more technical knowledge among the electrical inspectors and workmen to bring conditions up to a standard.

Moving Platform for Passenger Traffic.

A dinner was given at the Waldorf-Astoria on January 15 when Captain Max E. Schmidt described and illustrated by lantern slides the application of the moving sidewalk to the passenger traffic of New York and Brooklyn Bridges, as well as to other purposes of arterial travel in Greater New York. Captain Schmidt was the inventor and engineer of the well-known successful moving platform of this character installed on the long pier at the Chicago World's Fair in 1893, pictures and data of which were brought to the notice of the audience. Views were also shown of the highly successful elevated traveling sidewalk at the Paris Exposition of 1900 and the traveling freight roadway at Cleveland, Ohio, at the present time.

The subject was discussed in its various relationships by a number of those present, including several well-known engineers and such prominent city officials as Comptroller Metz and ex-Comptroller E. M. Grout. There was a consensus of opinion that while it might be difficult to apply the system to the old Brooklyn Bridge until such time as it is taken in hand for renovation and double-decking, it could be adopted immediately for such structures as the Williamsburg Bridge and the still incomplete Manhattan Bridge. The extraordinary carrying capacity of the moving platform as compared with a train of cars, as well as the smaller amount of current needed to haul the load, were matters of great surprise to those who had not studied the subject.

Among those present, several of whom participated in the discussion, were General Eugene Griffin, Mr. L. B. Stillwell, consulting engineer of the Interborough Railroad, and Messrs. Edward D. Adams, James C. Bayles, Stuyvesant Fish and T. C. Martin. Captain Schmidt is to deliver his lecture again at an early date before the New York Electrical Society.

Carnegie Technical Schools.

The appreciation of the educational facilities afforded by the Carnegie Technical Schools of Pittsburg is shown by the fact that no less than 7,000 applications were made for admission to the several departments of instruction. Of these, about 1,700 were for the Day School of Applied Science, nearly 4,000 for the Evening School of Applied Science, about 1,100 for the Trade School and approximately 800 for the Woman's School. The two latter have not yet been opened. Of the applicants for the two former, 623 for the Day School and 2,200 for the Evening School were found eligible to try the competitive entrance examinations. Those rejected were ineligible either on account of their youth, sixteen years being the lower limit, or on account of insufficient preparation in preparatory schools as determined by personal interview or correspondence.

The courses in the Day School of Applied Science extend over three years and comprise architectural, civil, chemical, electrical, railway motive power, foundry and mechanical practice. During the first year all students, irrespective of the course they may select, must pursue the same studies, this preliminary course being arranged to give a broad fundamental knowledge of the principles underlying the applied sciences. Only those can enter the specialized courses who during the first year give satisfactory evidence of their capacity. Those entering this school must pass satisfactory examinations in three of the four following subjects: English—ability to express thought in clear, concise and accurate English; mathematics—arithmetic and algebra as far as quadratics; science—elementary physics or chemistry; drawing—plain geometry or mechanical drawing. Certificates from high-schools or preparatory grades are accepted without an entrance examination, but no student is admitted who does not give evidence of a natural aptitude for technical work. The tuition fee is $20 per year for residents of Pittsburg, and $30 per year for all others.

The Night School of Applied Science was opened November 14, 1905. Sessions are held three evenings a week from 7:30 to 9:30 p. m.

Prof. A. J. Wurts has charge of all electrical instruction in the Carnegie Technical Schools.

The Convention and Exhibition in Chicago.

By Special Telegram.

Chicago, January 17.—This is a busy and eventful week in electrical history in this city as it witnesses the opening of the electrical exhibition and the holding of the Northwestern Electrical Convention. From the central station standpoint interest converges in the convention which was opened at 10 o'clock this morning at the Great Northern Hotel. There was the best attendance and the largest interest shown by central station men for many years past. The association appears in fact to have reached an important turning point in its history, from which new developments and advances will date.

All the papers presented are by central station men and are devoted to live central station topics. Moreover the papers are lively and interesting in their character and well prepared by their authors, while the discussion has so far reflected great credit on the efforts of President Williams and the executive committee to stimulate the participation of members and elicit valuable experiences.

After the routine business at the morning session, President Williams in his address called attention to the character of the programme this year. He also took occasion to point to the great opportunity that existed for developing and increasing the business of the majority of stations in the territory embraced by the Northwestern Electrical Association. A paper was then read by Mr. George H. Barrett, of La Crosse, on "The Proper Handling of Consumers' Meters." This was read for the author by Mr. Lord, and a good discussion in which many participated was opened up by Mr. Dinius, of Zion City.

At the afternoon session Mr. W. D. Burford, also of La Crosse, read a valuable and interesting paper full of practical data dealing with costs and details of modern underground construction. This was illustrated by stereopticon views of the new work just completed at the city of La Crosse. The paper was followed by a long discussion, also illustrated by lantern slides, by Mr. George B. Springer, of the Chicago Edison Company, on the work of that progressive corporation. Further discussion of the paper was contributed by Mr. Lukes, of Evanston; Mr. Gear, of Chicago; Mr. Almert and Mr. George Cutter.

A paper was then presented bristling with good points by Mr. G. H. Korst, of Janesville, Wis., on "Suggestions for Increasing the Power Output of Central Stations." This was well received and brought forth a brief lively discussion. The next paper—a short one—was that presented by Mr. John Williams, of Madison, Wis., on the "Organization and Development of New Business Departments." This elicited one of the best, most specific and practical discussions ever had at a central station convention on this vital topic. Mr. Almert scored the average central station manager for lax and backwoods methods, handling his victims quite severely, and outlining a specific plan of campaign for a small company. Mr. Frank R. Rae, Jr., commercial engineer, who, as is well known, has given considerable time and thought to the exploitation of central station advertising methods, gave a long talk full of good points dealing with the same question. Mr. Thomas G. Grier also discussed the subject from a very practical and pertinent standpoint. Others followed along the same line, and all of the discussion dealt with the practical side of the subjects and was extremely interesting.

For this evening theatre parties and entertainments are planned, but to-morrow the convention will get down to hard work again early in the morning. Among the papers and discussions laid out are those on the "Successful Application of New Business Methods," by Mr. John S. Allen, of Beloit; "Economies of Combined Railway and Power Plants," by Mr. Ernest Gonzenbach, of Sheboygan; "Effect of the Load Factor on Station Costs," by R. N. Kimball, of Kenosha.

Meantime the electrical show is commanding the attention and energy of practically all electrical Chicago, and the convention is to attend the show officially in a body on Thursday evening. The central station industry is to be congratulated on the vitality and interest displayed by the central station men of the West at this meeting, which augurs well for the future of the art.

The Grave of Franklin.

On several occasions during the past dozen years there has appeared in the press severe comment on the neglected state of Franklin's tomb in Christ Church graveyard, Fifth and Arch Streets, Philadelphia. That this reproach no longer applies is indicated by the accompanying reproduction of a photograph of the grave taken a few months ago. The railing shown was substituted in 1858 for a section of the high wall enclosing the graveyard, thus allowing the tomb to be seen from the sidewalk.

The grave is located in the corner of the graveyard at the intersection of Fifth and Arch Streets. That of Franklin is the one nearest to the rail covered by a slab (1) and bears the inscription:

Benjamin and Deborah } Franklin, 1790.

The trunk of a stately elm which shadows the grave is shown to the right. Of the upright stones at the head of the grave, that to the left is to the memory of John Reid, the father of Mrs. Franklin, and the other (2) bears the inscription "Francis

VIEW OF FRANKLIN'S GRAVE IN PHILADELPHIA.

F., son of Benjamin and Deborah Franklin, deceased Nov. 21, 1786, aged four years, one month and four days. The Delight of All Who Knew Him." The large slab to the left of Franklin's grave is inscribed:

Richard and Sarah } Bache, 1811.

the daughter and son-in-law of Franklin. Some years ago when excavating a part of the graveyard, a tombstone was discovered which bore the name of Dennis Franklin, a child of the great philosopher, who died at an early age.

Franklin in his will expressed the wish to be buried "with as little expense or ceremony as may be" by the side of his wife, who was interred Dec. 22, 1774; that "a marble stone be made by Chambers 6 ft. long, 4 ft. wide, with only a small moulding around the upper edge and this inscription:

Benjamin and Deborah } Franklin, 178 —

to be placed over us both." It would thus appear that Franklin lived longer than he had anticipated, his death taking place April 17, 1790. It is interesting to note the difference between the in-

scription which in his will he designated to be placed over his grave, and an epitaph he wrote for himself in 1728, when he was twenty-two years of age, as follows: "The body of Benjamin Franklin, printer (like the cover of an old book, its contents torn out and stripped of its lettering and gilding) lies here, food for worms. But the work shall not be lost, for it will (as he believed) appear once more in a new and more elegant edition revised and corrected by THE AUTHOR."

Franklin was buried April 18, 1790. Muffled bells were tolled and minute guns fired, and 20,000 people formed the cortége to the grave. Mirabeau, in announcing his death to the Constituent Assembly, spoke of him as "The sage whom two worlds claimed; the man whom the history of empires and the history of science alike contend for. Antiquity would have raised altars to his mighty genius."

Village-to-Village Transmission Lines in Illinois.

In view of the present interest in the subject of supplying several country villages over transmission lines from a central station located in one of the larger towns of the group, the following list of such transmission lines now in operation in the state of Illinois is of interest:

Hillsboro to Raymond, single-phase, 16,500 volts, 15 miles, 50-kw transformers; Elmwood to Brimfield, single-phase, 6,600 volts, 6½ miles, 30-kw transformers; Fairbury to Forrest, single-phase, 4¾ miles, 6,600 volts, 50-kw transformers; Amboy to Sublette, 10¾ miles, single-phase, 6,600 volts, 30-kw transformers; Gilman to Onarga, single-phase, 2,300 volts, 4 miles; Alpha to Rio, 6 miles, 2,200 volts, also Alpha to New Windsor. North Shore Electric Company, three-phase, 10,000-volt transmission lines connecting a number of stations and sub-stations in suburban districts around Chicago.

A Tremendous Foreign Trade.

The Bureau of Statistics, Department of Commerce and Labor, reports the foreign commerce of the United States for December and the twelve months ending December, as follows:

Merchandise— December—	1905	1904.	1903.
Imports	$101,155,363	$96,564,539	$77,768,634
Exports	199,709,068	145,287,264	174,819,566
Excess exports	$98,553,725	$48,722,725	$97,050,932
Twelve months ending December—			
Imports	$1,179,358,846	$1,035,907,370	$995,494,327
Exports	1,626,962,343	1,451,352,745	1,484,753,083
Excess exports	$447,603,497	$415,445,375	$489,258,756

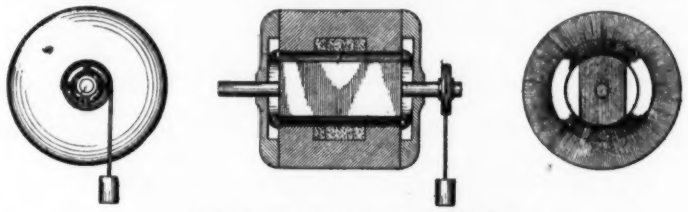
Electrical Opportunities in Massachusetts Towns.

A valuable pamphlet has just been issued by the Bureau of Statistics of Labor in Massachusetts, entitled "Industrial Opportunities not yet Utilized in Massachusetts." The pamphlet gives both in detail and in tabulated form the results of a circular letter which was forwarded to each of the 321 towns of the State, containing inquiries relative to land, water power, tax rebate, raw materials, natural products, available "help," railroad facilities, kind of business best suited to the town, water supply, light, electric railways and summer resorts. Returns were received from 231 towns, and as far as electrical opportunities are concerned it is evident that the expressions "overdeveloped East," "overcrowded New England," etc., so often heard in the newer parts of the country are still far from justified.

Of 206 towns replying to the question regarding electric light service, 104 are provided with electric lights, leaving 102 which are without central station current. In other words, nearly half the towns of the State are not yet provided with electric illumination. The electric railway facilities are much more extensive. Out of 214 towns reporting to the Bureau on the transportation question, 144 are served by trolley lines, leaving but 70, or approximately one-third, without this service. In 36 towns undeveloped water power of from 100 hp upward exists. Machine shops are desired in 15 towns. While many of the towns listed in the report are small rural communities, there is no doubt that the situations in some of them are well worth investigating.

Constant-Current Transformer.

An alternating-current regulator which possesses the distinguishing feature of employing no moving coils forms the subject of a patent issued January 2 to Mr. H. J. Blakeslee. The regulator consists of a transformer having stationary, primary and secondary coils wound on a cylindrical laminated frame. The primary coil is located in an annular recess in the middle of the frame, so as to encircle the core. The secondary coil is wound upon



CONSTANT-CURRENT TRANSFORMER.

polar projections which extend inwardly from each side of the middle of the cylindrical frame. Within the frame is placed a movable core, so mounted upon a shaft that a greater or less amount of flux from the primary threads through the secondary according to the position of the core. The current in the secondary is kept at practically a constant value by the use of a counterbalance fastened to a cord which passes around a pulley on the shaft of the core. The pull of the counterbalance tends to bring the core to the position giving maximum secondary current, and the torque due to the current in the secondary tends to bring the core to the position giving minimum secondary current. Therefore, the core being provided with a properly designed and adjusted counterbalance, the secondary coil can be made to deliver a current of constant value to a circuit of widely varying impedance.

Electrical Engineers of the Times.—XLV.

MR. A. PRESS.

Abraham Press was born in London June 5, 1877. He attended the Wesleyan Day School at Canterbury, Kent, and later received

MR. A. PRESS.

a scholarship at the Simon Langdon Middle Schools of the same town. From there he went to Beaufort College, St. Leonards-on-Sea, Sussex, and in 1892 came to America, where he attended the Cooper Institute Night Schools of Science and Art and graduated in 1899 with the degree of Bachelor of Science. Upon graduation Prof. William A. Anthony, of the Cooper Union,

proffered Mr. Press the position of honorary assistant in electrical measurements and general physical laboratory work.

Mr. Press assumed his first position in practical work with the F. A. La Roche Company, of New York. From there he went to the Otis Elevator Company, of Yonkers, and in 1892 returned to England, where he became connected with Messrs. Siemens Bros. & Co., Ltd., at their Woolwich works. While with this great firm of international reputation Mr. Press recognized the value of acquiring a knowledge of technical German and he applied himself to the acquisition of this language as well as to the study of French and Italian. With a bent for pure mathematics, he studied vector and harmonic analyses, calculus of variations and other branches of higher mathematics. Mr. Press has applied his knowledge of mathematics to a number of interesting technical problems, such as to the theory of commutation and other complex subjects in electrical engineering. With his ready and facile comprehension of intricate mathematical subjects, Mr. Press has been enabled to make many interesting contributions to electrical engineering literature, and it may well be said that his papers invariably show some distinctive feature of value. Of the articles published in British and American technical periodicals, the following illustrate the character of his work:

"The Approximate Minimum Flux Distribution Function for Iron Loss," "The Physical Interpretation of the Design Coefficient," "The Effects of Flux Distribution in Transformers and Solenoids," "The Leakage Coefficient of Induction Motors," "Electrical Heating Time Constants and the Theory of Commutation." Mr. Press is the author of a book on "Dynamo Design," recently published. Since his recent arrival in America from Europe, Mr. Press has accepted a position in the engineering department of the Bullock Electric Manufacturing Company under the direction of Mr. B. A. Behrend.

CURRENT NEWS AND NOTES.

NEW JERSEY FRANCHISES.—In his annual message, Governor Stokes, of New Jersey, recommends the limitation of the power of municipal officers to grant franchises for public utilities. He recommends the passage of a law making it impossible for communities to grant franchises for a longer period than twenty-five years. This, he contends, would enable a readjustment of terms according to the new conditions existing at the end of this period, and would edeminate the opportunity to grant concessions other than upon strictly business and legitimate conditions.

A. I. E. E. MEETING.—The two hundred and third meeting of the American Institute of Electrical Engineers will be held in the Assembly Room of the New York Edison Company, No. 44 West Twenty-seventh Street, on Friday, January 26, at 8.15 p.m. The following papers will be presented and discussed: "Central Station Economics," by Henry G. Stott, superintendent of motive power, Interborough Rapid Transit Company; "A Self-Exciting Alternator," by E. F. Alexanderson, electrical engineer with the General Electric Company, Schenectady, N. Y.

OPENING OF SIMPLON.—U. S. Consul Keene, of Geneva, reports that the opening of the Simplon Tunnel, which was fixed for April 1, has been postponed to May, by action of the Swiss authorities. The consul says: "The official opening of the new international line through the Simplon Tunnel, after having been advertised for April 1, 1906, is now reported as being postponed until May 1. After having been for a considerable time under discussion, the mode of traction between Brigue and Domo d'Ossola—i. e., on 40 kilometers (about 25 miles)—is reported to be electrical, in accordance with a decision recently made by the Federal Department of Swiss railroads."

NEW YORK ELECTRICAL SOCIETY.—The Society's "Franklin Night" for the celebration of the bi-centenary of the birth of America's first great electrician, which was arranged for January 16, when Mr. Marconi was to lecture before the Society, and had to be postponed until March in consequence of Mr. Marconi's illness, will be given at the Edison Auditorium, 44 West 27th Street, Wednesday, January 24, at 8 p. m. Dr. M. F. O'Reilly (Brother Potamian), Professor of Physics in Manhattan College, New York, will read an address on "The Electrical Work of Benjamin Franklin." After Professor O'Reilly's address, Mr. R. R. Bowker, will speak on "Franklin as a Statesman and a Man of Letters."

PRESERVING LOCAL INTEREST.—Many large service corporations get out of touch with the communities they operate in and thus lose local support and friendliness. In the circular for the special meeting of the stockholders of the United Railways Investment Company the stockholders are requested to ratify an arrangement to give the right to subscribe to the stock at not less than par to the directors, officers and higher employes of the companies in which the Investment Company may acquire an interest. The idea is to reward these officers and employes of the subsidiary companies by giving them the right to subscribe for the stock of the controlling company. The plan is useful in arousing a certain local interest in and support of the holding company and its subsidiary in case of agitations and "strikes."

WIRELESS IN SOUTH AMERICA.—United States Consul O'Hara, of Montevideo, reports that a company has been organized for the purpose of acquiring the right to use the Marconi system of wireless telegraphy in the Argentine Republic and in Uruguay. The capital stock is placed at $6,750,000 Argentine gold, or $6,413,750 American gold. It is divided into two series. Series A has 1,200,000 shares of $5 each, and Series B 150,000 of $5 each. The prospectus further announces that all the shares included in Series B have been delivered to the English companies in exchange for benefits obtained from the use of Marconi stations already constructed or in course of construction all over the world and in payment for the patents. These shares, so contributed, will be entitled to 80 per cent of the net earnings of the company. The shares that are offered to the public are 120,000 of Series B, 30,000 having already been subscribed.

ELECTRICAL TRADES ASSOCIATION.—The annual meeting and dinner of the Electrical Trades Association of Chicago will be held in the Coliseum Annex, Chicago, on the evening of January 24. Unusual interest is being manifested at this time and the anticipation is the largest meeting of credit men in the electrical trade ever held. Many electrical manufacturers and jobbers from Cleveland to Denver and from Detroit to New Orleans will be in attendance. At the dinner Mr. James Wolff will act as toastmaster, and the programme includes responses to be made by representative manufacturers and jobbers from the Central, Western and Southern territories. The Chicago Association numbers 155 members and the records for the past year will show remarkable work accomplished for its members through co-operative protection of credits. Mr. Frederic P. Vose, Marquette Building, Chicago, secretary and general counsel for the association.

TELEGRAPHY IN YUCATAN.—Belize, the capital of British Honduras, is now connected with the United States by the telegraph. U. S. Consul Avery explains that formerly messages were sent to New Orleans, then carried every Thursday by mail to Belize, requiring three days, or ten days if the weekly mail was missed at New Orleans. No tariff has yet been fixed, but the probable through rate from the United States will be $1 per word. The new telegraph lines connect with the Mexican system. The Mexican department of war erected the line from Payo Obispo, via Santa Crux, to Peto, Yucatan, about 225 miles—in 1901, solely for official purposes. Last November it was transferred to the department of public works and its use granted to the general public. Payo Obispo, Mexico, is across the Rio Hondo, 6 miles from Consejo, British Honduras. This gap in the telegraph line requires a boat as yet to carry the messages, but as soon as Mexican authority is granted a cable will be laid under the river. There will then be an unbroken line established from Belize to Galveston. The new line means much for American commercial interests in that region.

A ROYAL PRIZE.—In connection with the Milan International Exhibition of this year the King of Italy has offered among other prizes one of $10,000 for a simple and manageable apparatus to protect electrical mechanics from danger incurred in the performance of their duties.

NO CABLE, NO FLAG.—The London *Chronicle* says: "The novelty of a sale by auction of a British island is announced, the "lot" being the Fanning Island, and the auctioneer the Registrar of the British High Commissioner's Court at Fiji, who has issued advertisements in true auctioneer's style. The island contains only 150 inhabitants, and was seized by the British in 1888 as lying in the path of a possible submarine cable between Canada and Australia. The purchaser may turn his bargain to account by trading in mother-of-pearl, coral and guano."

COMMON SENSE NEEDED.—In commenting on a recent incident, the *Baltimore American* says: "The overconscientiousness of the Philadelphia telephone girl who refused to make connection with the Fire Department because the man at the other end of the line had not the necessary nickel to put in the slot nearly cost a life, and was another striking instance of the scarcity of common sense in the places where it is most needed. Ordinarily it is this ability to exercise common sense in an emergency that makes a human being more desirable in positions of responsibility than a mechanical contrivance. If it were otherwise the preference would be given in every instance to the automaton."

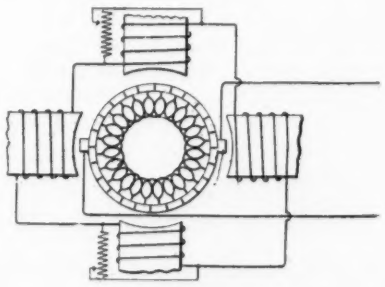
DEFECTIVE PARIS SUBWAYS.—A cable dispatch from Paris of January 13, says: "Investigation by members of the Paris Municipal Council has revealed serious defects in the Metropolitan underground railway, now in course of construction. Walls and pillars were found to have been constructed of a thickness much less than that specified by the contracts, and in many places the material used was too old to be lasting. At one point where the subway crosses a large stream, it was found that the supporting pillars were only 6 in. in diameter, instead of 50. The engineers in charge of the work and the contractors say the workingmen have disregarded their instructions received."

A STATUETTE OF MORSE, the gift of the Dutchess County Society of New York State, has been adopted by Sir C. P. Clarke, art director for the Metropolitan Museum of Art. It is supposed to be of French origin, and made in the early fifties. It is in bronze. In presenting the statuette at a public dinner last week Major F. H. E. Ebstein dwelt upon the career, with its hardships and ultimate triumphs, of Morse, claiming him as a citizen of Dutchess County, because he spent many years of his life there and died there. He added: "Before me is a statuette of Prof. Morse. It was discovered by William F. Kanerberg in the cellar of a London dealer in objects of art. He had bought it twenty years ago with other objects belonging to the estate of an English nobleman. It came into the possession of Mr. Charles Anthony Fowler, who was born in Dutchess County, who presented it to us. Believing that it ought to be in the Metropolitan Museum of Art, we present it to that organization through Sir Caspar Purdon Clarke."

AN INSURANCE GLOSSARY.—Announcement has been issued by the National Fire Protection Association, through Mr. W. H. Merrill, Jr., secretary, that the Committee on Uniformity of Requirements is prepared to compile a glossary of words, terms and phrases used in connection with the insurance business or the various trades, arts and sciences with which that business has to deal, and which are more or less commonly used or referred to in the reports and standards of the association. To that end the committee will undertake to list and define any words, terms or phrases that may be sent for that purpose to its chairman. The committee will also be glad to receive suggestions of definitions along with the words in cases where members have already made research and determined the same. Words having a special meaning in connection with trades and manufactures different from that commonly given them; or words having a meaning in one section of the country different from that attaching in another section; or words given a meaning different from any set forth in the dictionaries; along with special terms and phrases of similar character are of the kind that, if furnished, the committee will be glad to work upon. The committee, however, cannot undertake to hunt up this material for itself and, unless members co-operate by furnishing it, a glossary cannot be prepared. The assistance of every member is, therefore, earnestly requested. The chairman of this committee is Mr. H. E. Hess, 32 Nassau Street, New York City.

CORNELL UNIVERSITY GROWTH.—The 1905-6 register shows that the total number of regularly enrolled students in the University, exclusive of the students in the summer session and the short winter course in agriculture, is 3,385, an increase of 155 over last year. The total number of professors, assistant professors, etc., on the instructing staff is 473, an increase of 44. The requirements for the A.B. degree, the only degree awarded by the College of Arts and Sciences, have been made to include not only the satisfactory completion of a specified amount of elective, but also the completion of a four-year course of resident study. The University thus gives effective expression to its disapproval of the proposed shortening of the A.B. course. The College of Arts and Sciences will hereafter occupy the Goldwin Smith Hall, now nearing completion, at a cost of more than $300,000. The Rockefeller Hall of Physics, which is also to be completed for the opening of the year 1906-7 at a cost of $250,000, will give the University what is stated to be one of the finest and best equipped physical laboratories in existence. The College of Civil Engineering and the Sibley College of Mechanical Engineering both show large increases in attendance, the former now registering 418 students and the latter 1,086. Only the one degree of M.E. is now awarded in Sibley College, though students are allowed to specialize during their senior years in electrical engineering, railway mechanical engineering, naval architecture, etc., for which special certificates are given.

COMMUTATOR MOTOR WITH HIGH POWER-FACTOR.—A patent issued January 9, to A. S. McAllister relates to the improvement of the power factor of single-phase commutator motors. A non-inductive resistance is placed in shunt across the field winding of the machine, so that the field flux will lag behind the main circuit current. Under speed conditions the e.m.f counter generated at the armature by its rotation through the field flux will be in electrical time phase with the flux, and hence will lag behind the main circuit current. When the counter generated speed e.m.f. forms a sufficiently large part of the total circuit e.m.f., the main circuit current will be in phase with the circuit e.m.f., or it may be caused to lead the e.m.f. In the induction-series motor, shown in the accompanying diagram, the current in the armature is in phase opposition to that in the compensating coils which is the vector sum of that in the field coils and the shunting resistances. The counter-generated speed e.m.f. at the armature is in time-phase (opposition) with the current in the field coils, and hence it is in lagging quadrature with that component of the armature current corresponding to the current through the resistances in shunt to the field coils. At a certain armature speed, depending upon the relative values of the currents in the field coils and in the shunting resistances, the armature current is in phase with the circuit e.m.f. and the power factor is unity. At a higher speed or with a decrease of the shunting resistance the machine takes a leading current from the supply system.



MONORAIL.—The Behr Monorail Co. has applied to the Rapid Transit Commission for a route from the subway terminal in Brooklyn to Coney Island. The cars of this system rest upon a single raised rail and are shaped like an inverted V.

THE HIGHEST RAILWAY STATION, it is said, is that on Eismeer, at the Jungfrau electric railway. It is more than 10,000 ft. above sea level, and part of it is hollowed out of the rock of the mountain. This may be the highest electric station, but we are under the impression that there are one or two higher on steam railroads on the American continents.

BROOKLYN WIRES.—Borough President Coler has informed the public service corporations of Brooklyn, N. Y., that no more permits will be issued for the erection of poles along the streets, except those necessary for street lights. He said it is his purpose to compel the corporations to use underground conduits for all new work, and, if he finds he has the power, he will insist that all poles now standing be taken down and the wires strung upon them placed underground. A great deal of work has been done by the corporations in recent years in laying underground wires and cables.

SETTING ELECTRIC FIRES.—A special telegram from Delaware, O., of January 13, says: "An apparent plot to destroy the Carnegie Library here was discovered to-day. The library building, the $20,000 gift of Andrew Carnegie, is nearly completed. It was found that electric wires had been disconnected, cut, wrapped, and then sunk head in in wood about the building. These places were covered by highly polished ornaments. With the current of electricity turned on, as it will be the opening night, the building certainly would have been set afire. The work was done by an expert electrician."

GENERATING SINE-CURVE ELECTROMOTIVE FORCES.—In order to eliminate the upper harmonics from the curve of electromotive force of an alternator, K. A. Lindstrom, of Vestrias, Sweden, according to a patent issued January 9, would so arrange poles of different polarity of the magnetic field in relation to the halves of the windings of the armature that the harmonics generated in the one half will be practically displaced half a period in relation to the harmonics generated in the other half, so that the harmonics will nullify each other and the curve of electromotive force will be free from distortions.

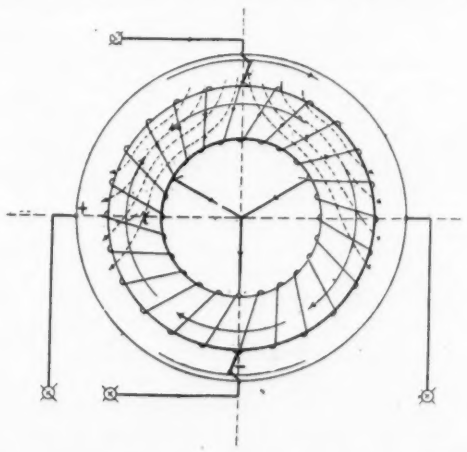
WIRES WEATHER-WISE.—According to a dispatch from Berlin, Germany, Dr. Eydam, a noted meteorologist, has discovered a new and extremely simple kind of barometer. It consists of the telegraph wire which is strung from pole to pole along the roadsides. Dr. Eydam declares that by listening closely to the sound made by the wind blowing across the wires any one can tell exactly what the weather is likely to be several days in advance. If the wires emit a deep, mellow and sustained note, like that of an organ, it means that the weather will be showery, with possible gales. A sharp, high note foretells cold, stormy weather, with, in winter, snow and sleet.

THOUSAND-MILE SPEECH.—As an incident of the printers' strike in New York and other cities, the Typothetæ or organizations of master printers are keeping in close touch by novel means. Between New York and Chicago, the long-distance telephone and the phonograph combined are used. In the office of the Chicago Typothetæ there is a megaphone which is connected with the long-distance telephone. The megaphone is placed in the room where the meetings of the Typothetæ are held daily. It acts as a receiver for the telephone transmitting to New York the speeches of the members of the Typothetæ, thus allowing the New York employers to learn exactly what their friends in Chicago are doing. In the same way the members of the Chicago Typothetæ are able to keep track of the progress of the New York fight, and the members of the two associations are as well informed as to each other's doings as though they were meeting in the same room, instead of hundreds of miles apart. The results are satisfactory

VIBRATIONITIS.—A cable dispatch from London of January 13 says that the increasing heavy underground traffic, in addition to the vibration caused by the underground railways, threatens Londoners with new troubles. "Vibrationitis" is said not only to cause disordered nerves, but it also affects structures. Dr. Winter Blyth, medical officer of health for the St. Marylebone Council, reports that the vibration from the heavy traffic and from the underground railways is having serious effects in St. Marylebone and St. John's Wood. "There have been so many instances of absolutely new drainage, namely carthenware pipe, embedded in concrete, in St. Marylebone, becoming defective in consequence of this excessive vibration, that I have been compelled to recommend iron in the place of earthenware pipes. The best built houses are also liable to be affected, and building accidents great and small have greatly increased of late years. In our own office in Upper Gloucester Place, Baker Street, I have found it impossible to put up a simple scientific instrument, such as a spectroscope, for photographic purposes, while at times the vibration is so great that it sets the telephone bell ringing." Nothing of this kind is known in connection with the New York subways.

POWER IN GERMANY.—U. S. Consul-General Richard Guenther, of Frankfort, reports as follows regarding the utilization of waterways in Germany for the production of electric power: "In the Prussian department of public works a monograph has been prepared with reference to the utilization of the water power created through the canalization of the rivers Moselle and Saar. It states that at the dams of the Moselle in Prussian territory about 35,000 horse-power and in the territory of Lorraine about 5,000 horse-power, and at the dams of the Saar about 10,000 horse-power will be available, a total of about 50,000 horse-power. This power will not at once be utilized at all the dams, and if so not to the full extent. For supplying larger amounts of power to the existing iron furnaces in Lorraine and in the Saar district, it is unfavorable that the furnace gases developed in the process are already used for generating power. For the larger cities, as Coblenz, Trier and Metz, however, the power of the dams in the vicinity could be profitably used, and the existing steam-electricity works could be utilized as a reserve and supplement for the water power created by the new dams."

SELF-STARTING SINGLE-PHASE INDUCTION MOTOR.—In a patent issued January 9, to M. Deri, of Vienna, Austria-Hungary, is disclosed a method for introducing special currents into the secondary of a single-phase induction motor for the purpose of giving to the rotor a starting torque and of supplying the exciting magnetomotive force during normal operation. The rotor winding is short-circuited at a number of points in-



divisible by the number of poles, so that it acts like a short-circuited secondary when the rotor is at full speed. The rotor winding is provided with a commutator the brushes on which are joined in series with the primary circuit either directly or by means of a transformer. The current introduced through into the rotor by way of the brushes, serves to give a starting torque to the rotor and assists in exciting the machine when full speed is reached.

Franklin and de Romas; or the Lightning Kite.

By Brother Potamian, Sc.D., *Lond.*
Professor of Physics in Manhattan College, New York.

I.

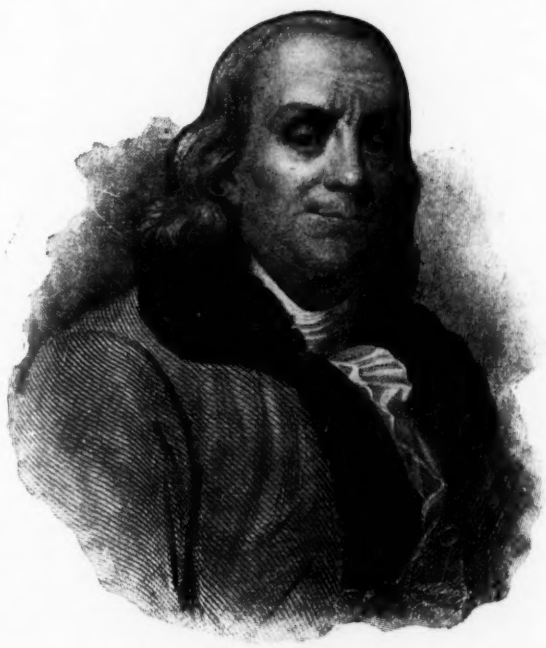
ANECDOTES relating to the pioneers of science have a peculiar fascination, especially for the youthful mind. A trivial occurrence, a quixotic performance, eccentricities of every kind are circumstantially remembered even when the achievements which made the men famous are often but dimly recollected. It is thus with the Eureka of Archimedes, Newton's apple and Franklin's kite. These incidents seem so natural that the delighted tyro refuses to consider them otherwise than authentic facts, as well established, forsooth, as the principle of upward pressure, the theory of universal gravitation or the identity of lightning and electricity with which they are severally connected.

Not so, however, experts in the "higher criticism," who are wont to announce their findings with statuesque unconcern for cherished traditions and pet theories alike. At one time it is the feat of the Syracusan philosopher that is branded as insane; at another, the falling apple is dismissed as too trifling to suggest a law of nature; while to-day it is the kite of the Philadelphia printer that is to be robbed of its charm and relegated to the limbo of myths.

The doubt concerning the kite performance was raised in an editorial note of the Electrical World and Engineer for April 1, 1890, in which it was asked whether Franklin ever made the experiment with which his name is associated; and, if so, whether he was not anticipated by M. de Romas in France. An attempt will here be made to answer both these queries, the writer drawing liberally on the Franklinana of the Wheeler collection of the American Institute of Electrical Engineers for the purpose.

Franklin was in his fortieth year when his attention was first drawn to electrical matters by a lecture which he happened to attend in his native town of Boston in the summer of 1746. Forthwith, glass rods and silk handkerchiefs were eagerly sought; and energetic rubbing became a serious occupation with the former journeyman printer. "I never before was engaged in any study," he wrote in 1747, "that so totally engrossed my attention and my time as this has lately done; for what with making experiments when I can be alone and repeating them to my friends and acquaintances who, from the novelty of the thing, come continually in crowds to see them. I have during some months past had little leisure for anything else."

If Franklin was not a genius, he certainly showed then and afterwards a good amount of the unlimited capacity for taking pains which is said to be associated with that gift. He carefully analyzed the new phenomena which he observed and submitted his explanations to the test of repeated experiment, knowing intuitively that experiment must be the touchstone of all theory. In this safe, practical way he soon discovered a number of facts about Leyden jars, then a novelty,[1] and the properties of points which subsequently proved of great importance both in electrical theory and in practical work. Some of these he communicated to Peter Collinson, of London, who had business relations with some merchants in Philadelphia. Collinson recognized at once their originality and importance, and hastened to make them known to fellow-members of the Royal Society. By these letters Franklin's name became noised abroad; and by association, that of Collinson was saved from oblivion.



BENJAMIN FRANKLIN.

In communicating Franklin's letters to the Royal Society, Collinson sought to have them accepted by the council for publication in the *Philosophical Transactions* of the year; but in this he was disappointed, as the electrical gropings of an uneducated colonial did not commend themselves, at the time, to the officials of that learned body! Even Franklin's memorable letter on the identity of lightning and electricity was dismissed with derisive remarks. Collinson regretted very much the action of the society; and, without waiting for a change of views, proceeded to publish Franklin's letters under the title of *New Experiments and Observations on Electricity made at Philadelphia in America.* The pamphlet appeared in 1751 and was almost immediately translated into French by M. d'Alibard, an academician, at the request of Count de Buffon. Unlike the original, the translation was eagerly bought up, a fact which shows the widespread interest in the new order of phenomena that had already been awakened in France by the experiments of Dufay and the brilliant demonstrations of Abbé Nollet. The Royal Society recognized, at last, the mistake that had been made, and condescended to offer a three-fold reparation for its contemptuous treatment of Franklin (1) by inserting in the *Phil. Trans.* a comprehensive account of his electrical discoveries drawn up by the celebrated Dr. Watson; (2) by electing him a member of the society, and (3) by awarding him the Copley medal in 1753.

Franklin's experiments were taken up in Paris with great enthusiasm by Count de Buffon, the naturalist; by M. de Lor, an instructor in physics; and by M. d'Alibard, a botanist of distinction. All three agreed to experiment independently with pointed conductors in accordance with the instructions given by Franklin; and all were finally able to report success; d'Alibard, on May 10; de Lor, on May 18, and de Buffon, on May 19, 1752. De Buffon erected his rod on the tower of his château at Montbar; de Lor, over his house in Paris, and d'Alibard, at his country seat at Marly, a little town eighteen miles from Paris. D'Alibard was not at home on the eventful afternoon of May 10; but before leaving Marly, he had drilled a certain Coiffier as to what he should do in case an electric storm came on during his absence. Though a hardy and resolute old soldier and proud of the confidence placed in him, Coiffier grew alarmed at the long and noisy discharges which he drew from the insulated rod on the afternoon of May 10. While the storm was still at its height he sent for the Prior of the place, Raulet by name, who hastened to the spot, followed by many of his parishioners. After witnessing a number of brilliant and stunning discharges, the priest drew up an account of the incident and sent it, at once, by Coiffier himself to d'Alibard, who was then in Paris. Without delay d'Alibard prepared a memoir on the subject which he communicated to the Académie des Sciences three days later, viz.: on May 13. In the concluding paragraph, the polished academician pays the following graceful tribute to the philosopher of the Western World:

"Il résulte de toutes les expériences et observations que j' ai rapportées dans ce mémoire, et surtout de la dernière expérience faite à Marly-la-ville que la matière du tonnerre est incontestablement la méme que celle de l'electricité; la voilà devenue une réalité; et j'ose croire, que plus on approfondira tout ce qu'il (Franklin) a publié sur l'electricité, plus on reconnaîtra combien la physique lui est redevable."*

This reads: "It follows from all the experiments and observa-

[1] Credit is given for the discovery of what came to be called the "Leyden Jar" to Dean von Kleist of Cammin in Pomerania, October, 1745. It is also attributed to Musschenbroek of the University of Leyden, January, 1746. The claim of Cunæus, a friend of the distinguished Dutch professor, is debatable. Franklin gave the theory of the jar in September, 1747. The reader will recall his "fulminating pane" and that most ingenious device his jar with movable coatings, as well as the terms positive and negative which he introduced to replace the terms vitreous and resinous of his French contemporary, Dufay.

*The works of Dr. Benjamin Franklin, Vol. III, p. 86. Philadelphia, 1809.

tions contained in the present paper and more especially from the recent experiment at Marly-la-ville, that the matter of lightning is, beyond doubt, the same as that of electricity; it has become a reality, and I believe that the more we realize what he (Franklin) has published on electricity, the more will we acknowledge the great debt which physical science owes to him."

We may, in passing, correct the error of those who credit French physicists with having originated the idea of the pointed conductor. Such writers should read the words of d'Alibard in the beginning of his memoir, where he says: "En suivant la route que M. Franklin nous a tracée, j'ai obtenu une satisfaction complète;[2] that is, "In following the way traced out by Franklin, I have met with complete success." To Franklin, therefore, belongs the idea of the pointed rod of 1750, which became the lightning conductor of subsequent years; to the Parisian savants belongs the great distinction of having been the first to make the experiment and verify the Franklinian view of the identity of the lightning of our skies with the electricity of our laboratories.

This leads to the focal point of the present inquiry, for it was while awaiting the erection of a public building in Philadelphia on which to raise his rod that the thought of the kite occurred to Franklin. Here is his letter anent the matter, written to Collinson on October 19, 1752.[3]

"As frequent mention is made in public papers from Europe of the success of the Philadelphia experiment for drawing the electric fire from clouds by means of pointed rods of iron erected on high buildings, it may be agreeable to the curious to be informed that the same experiment has succeeded in Philadelphia, though made in a different manner, which is as follows:

"Make a small cross of two light strips of cedar, the arms so long as to reach to the four corners of a large thin silk handkerchief when extended; tie the corners of the handkerchief to the extremities of the cross, so you have the body of a kite, which being properly accommodated with a tail, loop and string, will rise in the air, like those made of paper; but this being of silk is fitter to bear the wet and wind of a thunder-gust without tearing. To the top of the upright stick is to be fixed a very sharp-pointed wire, rising a foot or two above the wood. In the end of the twine next the hand is to be held a silk ribbon and where the silk and cord join a key may be fastened. This kite is to be raised when a thunder-gust appears to be coming on, and the person who holds the string must stand within a door or window, or under some cover, so that the silk ribbon may not be wet; and care must be taken that the twine does not touch the frame of the door or window. As soon as any of the thunder clouds come over the kite, the pointed wire will draw the electric fire from them, and the kite with all the twine will be electrified, and the loose filaments of the twine will stand out every way, and be attracted by an approaching finger. And when the rain has wetted the kite, so that it can conduct the electric fire freely, you will find it stream out plentifully from the key on the approach of your knuckle. At this key the phial may be charged, and from electric fire thus obtained spirits may be kindled, and all the other electric experiments be performed which are usually done by the help of a rubbed glass globe or tube, and thereby the sameness of the electric matter with that of lightning completely demonstrated."

Here we have the electric kite and manner of using it fully described without, however, any direct statement that the author himself actually experimented with it, although he does say that the experiment was successfully carried out. This is strictly true, but it may be safely contended that the precautions enumerated, the observation about the fibres of the cord, its improved conductivity when wetted by the rain and the like, all bespeak a knowledge of practical conditions that could be obtained only by way of experiment.

But if Franklin is not outspoken on the matter, some of his contemporaries are. Here is the kite incident as related in the *Continuation of the Life of Dr. Franklin*,[4] by Dr. Stuber, a Philadelphian and intimate friend of the Franklins:

"While Franklin was waiting for the erection of a spire, it occurred to him that he might have more ready access to the region of clouds by means of a common kite. He prepared one by fastening two cross-sticks to a silk handkerchief, which would not suffer so much from the rain as paper. To the upright stick was affixed an iron point. The string was as usual of hemp, except the lower end, which was silk. Where the hempen string terminated, a key was fastened. With this apparatus, on the appearance of a thunder-gust approaching, he went out into the commons accompanied by his son to whom alone he communicated his intentions, well knowing the ridicule which, too generally for the interest of science, awaits unsuccessful experiments in philosophy. He placed himself under a shed to avoid the rain. His kite was raised. A thunder cloud passed over it. No sign of electricity appeared. He almost despaired of success, when suddenly he observed the loose fibres of his string move toward an erect position. He now presented his knuckle to the key and received a strong spark. Repeated sparks were drawn from the key, the phial was charged, a shock, and all the experiments made which are usually performed with electricity."

This testimony of a man who enjoyed the unlimited confidence of Franklin, has a very matter-of-fact ring about it; there is not a note of uncertainty, not a word indicating doubt that his friend and neighbor went out to the fields accompanied by his robust son, carrying along with them a queer assortment of electrical impedimenta. This son, William by name, was twenty-two years of age at the time; and, as he died in 1813, eleven years after the publication of Dr. Stuber's biographical sketch, he had ample time to contradict the kite story if instead of being a fact it were a mere romance. Nor is this all, for Dr. Stuber's narrative, given above, appears textually in the "Memoirs of the Life and Writings of Benjamin Franklin," edited by his grandson, William Temple Franklin. The Doctor, be it remarked, was very fond of this grandson, whose "faithful service and filial attachment" he warmly commends in several of his letters, and whose regard for the memory of the statesman led him to undertake the task of preparing his works for publication. On page 211, Vol. I, he tells us that "As Dr. Franklin mentioned his electrical discoveries only in a very transient way, and as they are of a most important and interesting nature, it has been thought that a short digression on the subject would be excusable and not void of entertainment. For this purpose the following account of the same, including the first experiment of the Lightning Kite, as given by Dr. Stuber, is here given."

In these concluding lines we have the testimony of Franklin's grandson to the authenticity of the "Lightning Kite" story. Moreover, the account as given by Stuber evidently meets with his cordial approval since he transcribes it verbatim; and, as if to invest the quotations with unimpeachable authority, he tells us in the preface, p. viii, that "they deserve entire dependence because of the accuracy of the information imparted."

A word now from Priestley, also one of Franklin's intimate friends. In his *History of Electricity*, fourth edition, p. 171, he says that "Dr. Franklin, astonishing as it must have appeared, continued actually to bring lightning from the heavens by means of an electrical kite which he raised when a storm of thunder was perceived to be coming on." Then follows a description taken almost word for word from Dr. Stuber, whom he styles "the best authority on the subject."*

If, perchance, the above testimony should not be deemed conclusive and final, all lingering doubt must be removed by Franklin's own words, for in his autobiography, after briefly referring to the experiments made in France with pointed conductors, he adds: "I will not swell this narrative with an account of that capital experiment (the pointed conductor) nor of the infinite pleasure which I received on the success of a similar one I made soon after with a kite at Philadelphia, as both are to be found in histories of electricity."

Here, at last, we have Franklin's own word for it that he made the kite experiment and that he made it "soon after" the demon-

[2] The Works of Dr. Benjamin Franklin. Vol. III, p. 82, Philadelphia, 1809.
[3] The Works of Dr. Benjamin Franklin. Vol. III, page 110, Philadelphia, 1808.
[4] The Complete Works in Philosophy, Politics and Morals of the Late Dr. Benjamin Franklin. Vol. 1, p. 108, London, 1806.

* One of the earliest books on electricity published in the United States, *An Epitome of Electricity and Galvanism*, by two gentlemen of Philadelphia (Green and Hazard), 1800, has the following words: "Dr. Franklin made the assertion (of the identity of lightning and electricity) in 1750 and afterwards demonstrated its truth by undeniable experiment in 1752. This discovery is almost the only one in the whole science which has not been the result of accident," p. 40.

stration of his electrical discoveries which M. de Lor gave, by request, before Louis XV and his court.

II.

As to when this demonstration was given before the court, a letter from Abbé Mazéas, a distinguished physicist, will enable us to form some idea. Writing to Dr. Stephen Hales, the English philosopher, on May 20, 1752, he says that the "Philadelphia experiments which Mr. Collinson was so kind as to communicate to the public, having been universally admired in France, the King desired to see them performed. Wherefore the Duke d'Ayen offered His Majesty his country house at St. Germain, where M. de Lor, demonstrator of experimental philosophy, should put them into execution. His Majesty saw them with much satisfaction and greatly applauded Messieurs Franklin and Collinson. The applause of His Majesty having excited in Messieurs de Buffon, d'Alibard and de Lor a desire of verifying the conjecture of Franklin upon the analogy of lightning and electricity, they prepared themselves to make the experiment."

From this we infer that the electrical performance before the court must have taken place in the beginning of May, if not earlier, as some days must have intervened between the excitement it created in the mind of d'Alibard and the phenomenal success which he subsequently achieved on May 10.

It must be conceded that Franklin's adverbial phrase "soon after," as recorded above, is provokingly indefinite. Stuber, however, is a little more satisfactory; for after saying with exasperating rhetoric that "It was not until the summer of 1752 that Franklin was enabled to complete his grand and unparalleled discovery by experiment," he adds further on that it was made in the month of June. But why did not the Doctor, who was Franklin's neighbor and friend, state the day as well as he states the month and the year? Nor is Priestley any more precise; although he lived on terms of intimacy with Franklin during the philosopher's long residence in London, he volunteers no other information on the chronology of the electrical kite, save that the experiment was made "in June, 1752."

There can be no doubt that Franklin saw Priestley's account of his memorable experiment when the *History of Electricity* came out in 1767, if indeed, he did not see it in manuscript. What is certain is that he never found fault with the illustrious chemist and historian of electricity for exhibiting him to the world in the rôle of a kite-flyer; nor did he say a word in criticism of the time assigned for such a frolic. As we cannot impugn the veracity of Franklin or question the accuracy of Priestley or Stuber, we must conclude that June was the month of the year 1752 in which Franklin raised his kite to the sky and "drew lightning from the clouds."[5]

III.

We have now to see whether Franklin was anticipated in the idea of the kite or in its use for electrical purposes. There are some who hold that he was anticipated by M. de Romas as to the idea, but not the actual experiment; while others credit the French magistrate with both. Let us examine the evidence which there is for these opinions.

M. de Romas lived in Nérac, a small town some seventy-five miles south of Bordeaux. He was a member of the bar; and at the time of the Franklinian furor in Europe was a judge of the district court. He took an interest in scientific matters quite unusual for men of his profession, proceeding, as soon as he had read of the efficiency of pointed conductors, to study their behavior for himself. His experiments met with surprising success, and were as much admired by the local savants as they were dreaded by the common folk. Letters containing his observations were daily sent to the Academy of Bordeaux, where they were read with lively interest on account of their character and novelty. From the published *Actes* of that body we learn that the first kite used by de Romas was raised by him on May 14, 1753. Disappointment, however, attended this attempt, no electrical manifestation being observed, although rain fell and wetted the hempen cord. The magistrate of Nérac attributed his failure to the resistance of the string; and, like a good electrician, surprisingly good for the time, determined to improve its conductivity by wrapping a fine copper wire round its entire length. When this long and tedious operation was completed he went out again to the fields on a stormy day, when assisted by two of his friends, he raised the kite and soon got torrents of sparks from the wire-wound cord. This was on June 7, 1753. The experiment was repeated from time to time, both for his own satisfaction and that of his assistants, as well as for the entertainment of his ever-growing class of admiring spectators. Kites 7½ ft. long and 3 ft. wide were raised 400 and even 550 ft. above ground when flashes nine feet long and an inch thick were drawn, so the account says, with the report of a pistol. The effect must have been truly spectacular. The kite was held by a silk ribbon fastened to the end of the hempen cord.

It is then a matter of history vouched for by the *Actes* of the Academy of Bordeaux that May 14, 1753, is the day on which the first use of a kite for electrical purposes was made in France; on the other hand, it is to be remembered that Franklin flew his "lightning kite" in June, 1752, almost a year earlier. As far, then, as the *fact* is concerned, the Philadelphia philosopher was not anticipated by the Justice of Nérac.

From facts let us pass to writings. Franklin's letter to Collinson, in which he describes the electric kite, is dated October 19, 1752, while that of M. de Romas, on which the claim for priority is founded, was addressed by him to the Academy of Bordeaux on July 12, 1752, three months earlier. After a lengthy and interesting account of his experiments with pointed conductors, he concludes his communication as follows:

"C'est là, Monsieur, ce qu' il y a de plus important, car j'aurais bien d'autres particularités à vous communiquer; mais ma lettre, devenue d'une excessive longueur, m'avertit de finir. Je me réserve de mettre au jour la dernière (quoiquelle ne soit qu'un jeu d'enfant) lorsque je me serai assuré de la réussite par l'expérience que je me propose d'en faire et que je ne negligerai pas."

In English this would read: "Such, Sir, are the more important points which I have to communicate, and to which many others might be added, were it not for the excessive length of this letter, which warns me that it is time to bring it to a close. I will, however, give publicity to the last one of all (though it is only a child's plaything) as soon as I shall have assured myself of its success by an experiment which I have devised and which I shall not fail to make."

The words in brackets—"though it is only a child's plaything"—are all important, for it is on them and on them alone that the claim for priority has been put forth and maintained. It will be seen that the word kite (*cerf-volant*), does not occur in the letter, so that there can be no absolute certainty as to the nature of the *jeu d'enfant* which the author had in mind, though it is very likely that the kite was meant. In his *Mémoire sur les moyens de se garantir de la foudre dans les maisons*, he says, after describing some experiments that he had made with pointed rods: "Néanmoins toujours plein du désir d'augmenter le volume du feu électricque, il fallut chercher le moyen pour y parvenir. En conséquence, je me plongeai dans de nouvelles méditations. Enfin une demi-heure après, tout au plus, le cerf-volant des enfants se présenta tout à coup à mon esprit, et il me tardait de la mettre à l'épreuve. Par malheur, je n'en avais pas le temps." In English: "Being anxious to augment the quantity of electric fire, I began to think of some means to effect my purpose, and soon became quite absorbed with the subject. Not more than half an hour elapsed before the idea of the kite suddenly occurred to me, and I longed for an opportunity to try it; but unfortunately I had not sufficient leisure at the time." The work in which this passage occurs was published at Bordeaux in 1776, shortly after the death of the author. De Romas always maintained that he did not borrow the idea of the kite from any one, but that it occurred to him while pursuing his experiments with pointed conductors.

It must be admitted that de Romas could not have been acquainted with Franklin's performance of June, 1752, when he sent to the Bordeaux Academy his letter of July 12 of the same year, for we cannot suppose that in an age of sailing vessels such news would cross the Atlantic and reach an obscure provincial town in the southwest of France in the space of a month. On the other hand, it is equally improbable that a vague allusion to the electrical use of a kite made at Nérac on July 12 by a man

[5] Every schoolboy knows that the electricity which passed down the kite-string was not drawn from the clouds at all, but was due to their inductive action on the pointed conductor attached to the kite. Kant calls Franklin the "Modern Prometheus."

entirely unknown to fame as was de Romas, should be talked of on the banks of the Schuylkill before October 19, the date of Franklin's memorable letter to Collinson. Moreover, the *"jeu d'enfant"* allusion, as well as the very use of the kite by de Romas failed so completely to attract the attention of scientific men of his own country that he frequently and bitterly complained down to the end of his life in 1776 of their persistent neglect of his claims to recognition.

III.

A summary of this paper shows:

(*a*) That Franklin's "lightning kite" is not a myth, the experiment having been made by him in June, 1752, and fully described by him in a memorable letter written to Peter Collinson of London, dated October 19 of the same year;

(*b*) That de Romas independently had the idea of using a kite for electrical purposes as early as July 12, 1752; but that he did not carry out his idea until May 14, 1753; and, furthermore, that he did not succeed in getting any electrical manifestations until June 7, 1753, his success then being due at least in part to the clever idea which he had of entwining the cord with a fine copper wire. Therefore, *suum cuique.*

ADDENDA.

The Lightning Kite.

Fully described by Franklin in a letter to Peter Collinson, of London, dated October 19, 1752.

Stuber in his "Continuation of the Life of Dr. Franklin," and Priestley in his "History of Electricity," affirm that Franklin made the experiment in June, 1752.

Franklin's son, William, never denied the story, although he figured in it as an active character.

William Temple Franklin, who prepared for publication the first edition of his grandfather's works, gives the kite story almost verbatim from Stuber.

Finally, Franklin himself states that he made the experiment: Memoirs, Vol. I, p. 164.

Franklin and de Romas.

June, 1752: Franklin raises his kite in a field near Philadelphia.

July 12, 1752: Letter of de Romas to the Academy of Bordeaux, in which a probable reference is made to the kite as *un jeu d'enfant.*

October 19, 1752: Franklin describes the "lightning kite" in a letter to Peter Collinson, of London.

May 14, 1753: First use by de Romas of the electric kite in the fields around Nérac; no result.

June 7, 1753: First success by de Romas with his electric kite.

Pointed Conductor.

Suggested by Franklin in letter to Peter Collinson, of London, dated July 29, 1750.

D'Alibard, following Franklin's instructions, gets torrents of discharges from his iron rod 40 feet high at Marly, May 10, 1752.

De Lor gets good results from his conductor 99 feet high erected over his house in Paris, May 18, 1752.

De Buffon succeeds with his rod on May 19, 1752.

Franklin erected the first rod over his house in Philadelphia in September, 1752. It was made of iron with a sharp steel point rising seven or eight feet above the roof, the other end being sunk five feet in the ground. Franklin charged a Leyden jar from his rod in April, 1753. Professor Richman, of St. Petersburg, was killed by a flash from his apparatus on Aug. 6, 1753.

In Memory of Franklin.

The master printers' association celebrated the 200th anniversary of Franklin's birth by a dinner at the New Grand Hotel in New York on January 16. Several prominent persons made remarks extolling Franklin not only as one of the great Americans but as an American pioneer in printing. In speaking on "Our Debt to Franklin," Rev. Dr. S. Parkes Cadman praised the overwhelming personality of Franklin. The great trait in Franklin's character, he said, was humanness. Mr. John R. Dunlap, editor of *Engineering Magazine,* spoke of Franklin as a politician. Franklin's great characteristic, he said, was "his everyday, ordinary kind of common-sense." The Pennsylvania Society on Wednesday placed a wreath on the statue of Franklin in Printing House Square, New York.

Benjamin Franklin, Electrician.

Any proper estimation of the electrical work of Benjamin Franklin should take into consideration both the state of electrical science at the period when the great philosopher contributed to it, and the verdict of the day on the value of his contributions. Without such aid, the immense gulf which separates scientifically the middle of the eighteenth century from the beginning of the twentieth century would tend to dwarf the proportions of his achievements, however great they loomed up at the time.

In sketching electrical development up to the day of Franklin, only six names need be cited: Gilbert, Guericke, Hawksbee, Gray, Dufay and Musschenbroek. Gilbert (1540-1603) founded the science of magnetism, and was the first to apply what may be called the modern scientific method to the investigation of physical phenomena. Guericke (1602-1686) made the first electrical generator, and by its means was the first to produce light by electricity; he was also the first to assert, otherwise than in pure speculation, the identity of electricity and lightning. Francis Hawksbee (——1713) discovered that by means of an electrical charge a vacuum tube may be caused to give forth light. Stephen Gray (——1736) discovered the properties of electrical conduction and insulation, and some of the phenomena of static induction. Charles Francois Dufay (1698-1739) took up the work of Gray, which he greatly extended. He discovered that all bodies, solid or liquid, could be electrified; that substances most easily electrified by friction are the worst conductors, and vice versa; and was the first to use the terms conductor and non-

BENJAMIN FRANKLIN.

By permission of Mr. John Wanamaker.

conductor. He was also the first to draw a spark from the human body and to establish the principles of electrostatic induction, the phenomena of which had been faintly recognized by Guericke and Gray. His greatest achievement, however, was in evolving the first theory of electricity—in his own words, the discovery of "two distinct kinds of electricity, very different from one another; one of which I call vitreous electricity and the other resinous electricity." This was the beginning of the theories of fluid electricity which, though receiving a death blow at the hands of Faraday, lingered until within recent years, and are yet useful for illustrative purposes.

The work of Gray and Dufay ended about 1735 and the next epoch commences with the discovery of the Leyden jar in 1745 and extends through Franklin to the time of Volta, who stands as sponsor for modern electricity. This discovery was announced by Musschenbroek (1692-1761) in 1746, though it has been claimed that Dean von Kleist, of Cammin, Pomerania, had experimented with a Leyden jar arrangement the previous year.

While the work of Gilbert, Guericke, Hawksbee, Gray and Dufay has more or less intrinsic value from the scientific point of view, and though it formed the foundation upon which others built and furnished inspiration that led to wonderful advances, it was left to Benjamin Franklin to make the first real practical application of electrical knowledge. With Franklin was first brought into electrical investigation the modern practical spirit which is not satisfied with mere brilliant experiment and lofty speculation, but has for its final aim the adaptation of nature's phenomena to the service of man.

The impression which the work of Franklin produced in Europe was remarkable. Referring to the several letters of Franklin to Collinson, of the Royal Society, published between 1747 and 1754, which cover the period of his great electrical investigations, Priestley, in his "History of Electricity," published in 1767, says:

"Nothing was ever written upon the subject of electricity which was more generally read and admired in all parts of Europe than these letters. There is hardly any European language into which they have not been translated; and, as if this were not sufficient to make them properly known, a translation of them has lately been made in Latin. * * * Though the English have not been backward in acknowledging the great merit of this philosopher, * * * to form a just idea of the great and deserved reputation of Dr. Franklin, we must read the foreign publications on the subject of electricity; in many of which the terms Franklinism, Franklinist and Franklinian system occur on almost every page."

When we consider this was written by a great European scientific authority concerning a man previously unheard of in science, and living in a new world, less known to Europe than Argentine is to us at the present day, its full import can be appreciated.

Franklin's first important experiments were with the Leyden jar to charge which he constructed a glass static machine of his own design. He discovered, by a beautifully scientific series of experiments, that the power of giving a shock lies in the glass itself and not in the metal coatings. As a deduction from his theory of electricity, he concluded that jars might be coupled together and thus produce an effect in proportion to the number used, and upon this principle he constructed batteries of such power that he was led to write "There are no bounds to the force man may raise and use in the electrical way; for bottle may be added to bottle and the greatest known effects of common lightning may, I think, without much difficulty, be exceeded in this way."

Franklin held that there is but one electric fluid, which ordinarily exists in a body in a state of equilibrium; if some of the fluid is drawn off the body exhibits negative properties, or positive properties if added to. While this theory of electricity did not prevail over that of Dufay, it nevertheless had supporters for more than a century, though both theories were untenable from the day of Faraday.

Franklin, however, is best known through his experimental identification of lightning with electricity. Though there had been many speculations on this subject, notably by Guericke, and, in some detail, by the versatile Abbe Nollet, none was so definite as that put forth by Franklin in 1749; and finally, in 1750, he proposed in detail an experiment to determine the question whether clouds that contain lightning are electrified or not, and at the same time laid down the principles of the lightning rod which were held up to within a very recent period. A full account of this phase of Franklin's work is given elsewhere in the admirable article by Brother Potamian, which study promises to settle definitely the century and a half old controversy as to priority in actually drawing lightning from the clouds.

According to Franklin's celebrated theory of the lightning rod, a pointed rod gradually draws off the electricity in the atmosphere, thus dissipating a charge before it becomes formidable. Some distinguished European savants disputed the superiority of pointed rods, which gave rise to the famous "points vs. knobs" controversy. Franklin defended his views with the remarkable skill which he invariably displayed, whatever the occasion, and emerged from the controversy an acknowledged victor. As a lightning discharge is now considered to be due to the breaking down of the air between the object struck and a charged cloud, through the existence of an enormous dielectric stress, this theory has now only a historic interest.

In Portsmouth, N. H., a lightning rod put up under the direction of Franklin, consisting of an iron rod about a half inch in diameter, was still in use a few years ago. The Franklin Institute of Philadelphia has a static machine made by Franklin and a Leyden jar battery made by him is still in use in Dartsmouth College.

It is remarkable that little or no contemporary corroborative evidence exists relating to the remarkable experiments which have earned for Franklin the popular title "Father of Electricity." It is partly for this reason, but more largely from the singular form of Franklin's own accounts of his experiments, that the fact of their actual performance has been challenged. As to the kite and lightning rod experiments, the reader is referred to the article elsewhere by Brother Potamian. We print below the account of the celebrated "Electrical feast," together with the note which accompanies it on the use of an earth return. No corroboration that the feast took place has up to the present been discovered, yet the note might lead the reader to believe that at some time the suggestion of an electrical dinner had been carried out. Did Balzac have the "electrical feast" in mind when he wrote "Franklin invented the lightning rod, the hoax and the republic"? The account appears in Franklin's "Experiments and Observations on Electricity," published in 1751, of which other editions, in each case with new matter added, were printed in 1752, 1754 and 1766. Later editions are dated 1769 and 1774. The editions of 1751, 1754, 1769 and 1774 are in the Wheeler Gift in the library of the American Institute of Electrical Engineers, which also includes English reprints dated 1760 and 1765, copies of French translations dated 1752 and 1756, and of a German translation dated 1758. The account closes a letter to Peter Collinson, Esq., F.R.S., London, dated "Philadelphia, 1848," which relates in detail the celebrated experiments with an "electrical phial" (Leyden jar) above referred to:

"Chagrined a little that we have been hitherto able to produce nothing in the way of use to mankind; and the hot weather coming on, when electrical experiments are not so agreeable, it is proposed to put an end to them for this season, somewhat humorously, in a party of pleasure, on the banks of the Schuykil. Spirits, at the same time, are to be fired by a spark sent from side to side through the river, without any other conductor than the water; an experiment which we some time since performed, to the amazement of many.* A turkey is to be killed for our dinner by the electrical shock, and roasted by the electrical jack, before a fire kindled by the electrical bottle; when the healths of all famous electricians in England, Holland, France and Germany are to be drank in electrified bumpers† under the discharge of guns from the electrical battery."

The original from which the accompanying portrait of Franklin is reproduced was drawn in pencil by Benjamin West. It formed part of the Pennypacker collection of Franklinana recently sold at auction in Philadelphia, and was purchased by Mr. John Wanamaker, through whose courtesy we are enabled to present the reproduction.

Franklin's Grave.

A telegram to the New York *Sun* reports that while societies of various kinds, schools and other institutions in Philadelphia and other cities were holding exercises on Wednesday in honor of Benjamin Franklin's birthday the grave of the philosopher and his wife, in the old burial ground, at Fifth and Arch Streets, remained forsaken and neglected. There was not a flower, not a wreath, on the great slab. Only above the head of the grave waved a tattered, discolored little flag which some veteran placed there last Decoration Day.

* "As the possibility of this experiment has not been easily conceived, I shall here describe it. Two iron rods, about three feet long, were planted just within the margin of the river, on the opposite sides. A thick piece of wire, with a small round knob at its end, was fixed to the top of one of the rods, bending downwards, so as to deliver commodiously the spark upon the surface of the spirit. A small wire fastened by one end to the handle of the spoon, containing the spirit, was carried across the river, and supported in the air by the rope commonly used to hold by, in drawing the ferry boats over. The other end of this wire was tied round the coating of the bottle, which being charged, the spark was delivered from the hook to the top of the rod standing in the water on that side. At the same instant the rod on the other side delivered a spark into the spoon, and fired the spirit, the electric fire returning to the coating of the bottle, through the handle of the spoon and the supported wire connected with them. That the electric fire thus actually passes through the water, has been satisfactorily demonstrated to many by an experiment of Mr. Kinnesley's, performed in a trough of water about ten feet long. The hand being placed under water in the direction of the spark (which always takes the straight or shortest course) is struck and penetrated by it as it passes."

† "An electrified bumper is a small thin glass tumbler, near filled with wine, and electrified as the bottle. This when brought to the lips gives a shock, if the party be close shaved, and does not breathe on the liquor."

Some Important Foundations of Benjamin Franklin.

By Dr. Edwin James Houston.

AMONG other examples that might be given of great public works undertaken by Benjamin Franklin for the good of the City of Philadelphia in particular, and of the world in general, perhaps none are so worthy of mention as the foundation of the great Philadelphia Library, the University of Pennsylvania and the American Philosophical Society. These public institutions, although differing markedly among themselves, yet are nevertheless in accordance with the principles that so eminently characterized this great man. Franklin was a pronounced utilitarian, and may properly be regarded as the apostle of thrift in early provincial times. He was eminently a self-educated man, a man who understood the influence of the proper combination of industry and economy. It is, therefore, natural that he was desirous of securing for others the advantages that are to be derived by companionship with books, by intimate contact with bright minds, and would naturally desire to establish some place where a proper education could be insured for all capable of acquiring it.

The three public institutions above named were founded by Franklin in the following order: The Philadelphia Library, the University of Pennsylvania, and the American Philosophical Society, the approximate dates of their foundations being respectively 1732, 1740 and 1743. We use the phrase approximately intentionally for reasons since in some cases the exact dates are uncertain.

Since Benjamin Franklin was born in 1706, it will be seen that he was quite a young man when he started what afterwards became the great Philadelphia Library, and was far from being advanced in life when he founded the other two great institutions.

Before briefly relating the circumstances under which the above-named work was accomplished, it may be well first to call attention to such other institutions as the Franklin and Marshall College, the Franklin Institute and other institutions that have been founded along the lines that were at this early date laid down by Benjamin Franklin; for, while these institutions cannot strictly be regarded as having any direct connection with Benjamin Franklin, yet their foundation can, to a great extent, be regarded as having been greatly influenced by the prior work undertaken by this practical philosopher.

The origin of the great Philadelphia Library—or, as it is more exactly called, the Library Company of Philadelphia—is to be traced to the need experienced by young Franklin and some of his intimate friends for books. In these early days books were quite different things from what they are to-day. Instead of the attractive and readily handled duodecimos of to-day, books consisted then for the greater part of heavy, ponderous folios, that were too expensive to be possessed by hardly any but the fairly prosperous, and even by them in but comparatively small numbers. Such books did not readily lend themselves to circulation.

Before the time when Franklin conceived the idea which resulted in the birth not only of the Philadelphia Library, but also of practically all circulating libraries in America, he had formed a little coterie or society called the "Junto." The membership in this society was strictly limited to 12. As originally constituted, the society met on Fridays. The Junto constituted in fact a debating club, and was based on rules that required every member in his turn to prepare one or more queries on various points in morals, politics or natural philosophy, which were to be discussed by the club at its meetings. Once every three months each member was to read an essay, composed by himself, on any topic that he chose to select. The debates were under the direction of a president, and in order to prevent quarrels, all expressions of positiveness in opinions, or direct contradictions, were prohibited under small pecuniary penalties.

An examination of the membership of this early society shows that no little tact had been exercised in its selection. Some of the more important members of this society included such names as Thomas Godfrey, a self-taught mathematician and the inventor of what was afterwards known as Hadley's quadrant; Nicholas Scull, a surveyor; William Parsons, bred a shoemaker, but afterwards acquiring considerable knowledge of mathematics; Wm. Maugridge, a joiner, and an excellent mechanic; Robert Grace, a young gentleman of some fortune, and Wm. Coleman, a merchant's clerk. This last member was more nearly of Franklin's age than the others, and continued in close friendship with him up to the time of his death, some 40 years afterwards.

The dearth of books experienced by the members of the Junto suggested to Franklin's ingenious mind the advisability of arranging some plan by which the books accessible to the members would be increased. As Franklin says in his Autobiography:

"At the time I establish'd myself in Pennsylvania, there was not a good bookseller's shop in any of the colonies to the southward of Boston. In New York and Philad'a the printers were indeed stationers; they sold only paper, etc., almanacs, ballads, and a few common school-books. Those who lov'd reading were oblig'd to send for their books from England; the members of the Junto had each a few. We had left the alehouse, where we first met, and hired a room to hold our club in. I propos'd that we should all of us bring our books to that room, where they would not only be ready to consult in our conferences, but become a common benefit, each of us being at liberty to borrow such as he wish'd to read at home. This was accordingly done, and for some time contented us.

"Finding the advantage of this little collection, I propos'd to render the benefit from books more common, by commencing a public subscription library. I drew a sketch of the plan and rules that would be necessary, and got a skillful conveyancer, Mr. Charles Brockden, to put the whole in form of articles of agreement to be subscribed, by which each subscriber engag'd to pay a certain sum down for the first purchase of books, and an annual contribution for increasing them. So few were the readers at that time in Philadelphia, and the majority of us so poor, that I was not able, with great industry, to find more than fifty persons, mostly young tradesmen, willing to pay down for this purpose forty shillings each, and ten shillings per annum. On this little fund we began. The books were imported; the library was opened one day in the week for lending to the subscribers, on their promissory notes to pay double the value if not duly returned. The institution soon manifested its utility, was imitated in other towns, and in other provinces. The libraries were augmented by donations; reading became fashionable; and our people, having no publick amusements to divert their attention from study, became better acquainted with books, and in a few years were observ'd by strangers to be better instructed and more intelligent than people of the same rank generally are in other countries."

Speaking for himself, Franklin calls attention to the fact that the establishment of this library offered him means for self-improvement by constant study. He says: "Reading was the only amusement I allowed myself. I spent no time in taverns, games or frolics of any kind, and my industry in my business continued as indefatigable as it was necessary."

The books of this early library were at first kept at the house of Mr. Robert Grace, one of the members of the Junto before referred to. They were afterwards placed in a room in the old State House building.

In 1742 a charter was obtained from the Proprietaries for the library. In 1790 the library was removed to Carpenter's Hall, from which building it was subsequently removed and placed in quarters erected for the purpose near Fifth and Chestnut Streets. The books remained in this building until they were removed to the present quarters of the library at Locust and Juniper Streets.

The size of the library on its removal to Fifth and Chestnut Streets was only 8,000 volumes. At the present time, according to a report of the Library Company of Philadelphia for May, 1905, it contains no less than 216,946 books.

The Ridgeway Branch of the Philadelphia Library Company was founded on a legacy left by Dr. James Rush, in 1869. This legacy amounted to nearly one million dollars. The money was left on the condition that the library building should be erected on the square of ground bounded by Broad and Thirteenth Streets and by Christian and Carpenter Streets. Owing to an effort made by the authorities of the Library Company of Philadelphia to prevent the erection of the library on this ground,

the building was not completed until 1878. The name Ridgeway Branch of the Philadelphia Library was given to this branch in memory of Dr. Rush's wife, who was the daughter of Jacob Ridgeway.

The Philadelphia Library contains a number of almost priceless books. Among other gems of this collection are to be found:

(1) A number of exceedingly rare manuscripts, together with fine specimens of early illuminated manuscripts of Caxton, Fust & Schaeffer, Pynson, Wynkyn de Worde, Sweynheym & Pannartz.

(2) A copy of the Praeparatio Evangelica, printed in 1470.

(3) A commentary on the Psalms printed on vellum in 1470.

(4) A copy of the Holy Bible printed by Sweynheym & Pannartz in 1471, and many others.

Among some of the rare books belonging to the Ridgeway Branch of the Library Company of Philadelphia, is a small work entitled "A Catalogue of Books Belonging to the Library Company of Philadelphia, Philadelphia (Franklin), 1741." This book is a small duodecimo, containing 56 pages. On the last page is found a short account of the library, concluding as follows: "Tho' 'tis composed of so many persons, of different Sets, Parties and Ways of Thinking, yet no differences relating to the affairs of the Library have arisen amongst us."

Some idea of the general use of this library may be gained from the fact that, according to the above-mentioned report, during 1905 the Library was open for 310 days, and during this time more than 34,000 books were taken out. The number of visitors to the building was 64,083, an increase since 1904, when the number only reached 53,075. The amount expended for new books and binding during this year was $6,029.

The foundation of the great University of Pennsylvania may be regarded as having had its origin in an English Charity school founded by Benjamin Franklin in 1740. This school was established on Fourth Street in Philadelphia. The school thus founded did not take on the collegiate form until 1751.

In 1749 Franklin published his famous treatise on "The education of Youth in Pennsylvania." He adopted this plan of calling the attention of the community to the needs for the education of youth so as to make it easier for him to obtain the necessary subscriptions for the foundation of the school. As soon as this had been accomplished the old school building on Fourth Street was rebuilt, a board of trustees elected and a school known as "The Academy of Philadelphia" was founded in January, 1751. This school achieved great success, and had enrolled on its list over 100 students. The "Academy of Philadelphia" included three different departments: i. e., the Department of Latin, the Department of English and the Department of Mathematics.

In May, 1755, the Academy of Philadelphia received an additional charter, and became "The College and Academy of Philadelphia." The college elected as its first rector the Rev. Wm. Smith, of the University of Edinburgh.

Some time after the establishment of the College and Academy of Philadelphia, the Assembly of the State of Pennsylvania revoked the charter of the college and gave it to a new institution that was styled "the University of the State of Pennsylvania." The trustees of the old College and Academy of Philadelphia, however, maintained their organization and succeeded, in 1789, in regaining their old charter. Finally the two rival institutions were consolidated in 1791 under the name of "The University of Pennsylvania."

The great University of Pennsylvania is too well known to need any description.

Franklin may also be regarded as being the founder of the American Philosophical Society. This was in the year 1743. This society had its origin in a paper published by Franklin, dated May 14, 1743 (Old Style), entitled "A proposal for Promoting Useful Knowledge among the British Plantations in America."

This paper calls attention to the great extent of the Colonial possessions, with their marked differences in climate, soil and natural products. It then says:

"The first drudgery of settling new colonies, which confines the attention of people to mere necessaries, is now pretty well over; and there are many in every province in circumstances that set them at ease, and afford leisure to cultivate the finer arts, and improve the common stock of knowledge. To such of these who are men of speculation, many hints must from time to time arise, many observations occur, which if well examined, pursued and improved, might produce discoveries to the advantage of some or all of the British Plantations, or to the benefit of mankind in general. . . . . But as, from the extent of the country, such persons are widely separated, and and seldom can see and converse or be acquainted with each other, so that many useful particulars remain uncommunicated, die with the discoverers, and are lost to mankind; it is to remedy this inconvenience for the future, proposed—

"That one society be formed of virtuosi, or ingenious men, residing in the several colonies, to be called the American Philosophical Society, who are to maintain constant correspondence.

"That Philadelphia, being the city nearest to the centre of the continent colonies, communicating with all of them northward and southward by post, and with all the islands by sea, and having the advantage of a good growing library, be the centre of the Society.

"That at Philadelphia there be always at least seven members, viz., a physician, a botanist, a mathematician, a chemist, a mechanician, a geographer, and a general natural philosopher, besides a president, treasurer and secretary.

"That these members meet once a month, or oftener, at their own expense, to communicate to each other their observations and experiments; to receive, read and consider such letters, communications, or queries as shall be sent from distant members; to direct the dispersing of the copies of such communications as are valuable, to other distant members, in order to procure their sentiments thereupon."

The society was apparently founded some time during the year 1743, since Franklin, in a letter to Cadwalader Colden, dated April 5th, 1744, refers to the society as already formed, and as having had several meetings.

The original membership in this society included Dr. Thomas Bond as physician, Mr. John Bartram as botanist, Mr. Thomas Godfrey as mathematician, Mr. Samuel Rhoads as mechanician, and Mr. Wm. Parsons as geographer. Dr. Phineas Bond was general natural philosopher. Mr. Thomas Hopkinson was elected President, Mr. Wm. Coleman Treasurer, and Benjamin Franklin Secretary.

About the beginning of the year 1769, the American Philosophical Society and another society known as the American Society, held at Philadelphia for Promoting Useful Knowledge, were merged into a single society.

The first meeting of the combined societies was held January 2, 1769. The first president of this society was Benjamin Franklin. The vice-presidents were Dr. Thomas Bond, Dr. Thomas Cadwalader and Joseph Galloway. This society was incorporated by the General Assembly of Pennsylvania on the 15th of March, 1788.

At the present time the society occupies quarters in a portion of Independence Square, the site for this purpose having been granted to them by the State in 1785.

Subsequently, an act was passed by the Legislature permitting the society to rent out such portions of its hall as were not required for the purposes of the association. In this manner the society receives a sum which goes far towards paying its expenses.

The two trust funds left by Franklin for the benefit of the cities of Philadelphia and Boston have an interesting history. In his will, dated July 17, 1788, legacies of £1,000 were left to each of these cities, which, with accumulations, were to be loaned under certain specified conditions at 5 per cent interest, and the amount accrued at the end of a century devoted to specific purposes. This fund became available on Franklin's death, April 17, 1790. The growth of the fund, however, fell far short of the founder's expectations, as set forth in his will. Franklin calculated that at the end of the first one hundred years the £1,000 would have increased to £131,000. Of this amount £100,000 was to be devoted to purposes specified and the remaining £31,000 was to be loaned under the original conditions for another one hundred years. Franklin estimated that at the end of this second term the sum would amount to £4,000,061, which amount was then to be finally disposed of for specified purposes.

In the case of Boston, the amount available at the end of the first one hundred years was to be expended in public works, such as fortifications, bridges, aqueducts, public buildings, baths, pavements or whatever might make living in the town more convenient to its people and render it more agreeable to visitors. Of the great sum anticipated at the end of the second century, £1,000,061 was to be placed at the disposal of the inhabitants of the city of Boston, and £3,000,000 at the disposal of the government of the city.

As to the city of Philadelphia fund, at the end of the first one hundred years the sum of £100,000 was to be expended for bringing the waters of the Wissahickon Creek into the city to supply the inhabitants with pure water, and the sum of £4,061,000 anticipated to be available at the end of the second century was to be divided between the inhabitants of the City of Philadelphia and the government of Pennsylvania.

The actual outcome fell far short of the anticipations of Franklin. The value of the Philadelphia legacy at the end of one hundred years, namely, April 1, 1890, was only $87,600.29. In March, 1895, the city of Philadelphia appropriated the proceeds for the erection of an art gallery to be located in Fairmount Park, "that portion of the building so paid for to have the name of Benjamin Franklin connected with it in such a manner as to serve to perpetuate his memory." This appropriation was accepted by the park commissioners in 1895, but up to the present date there has been no further action and the funds remain with the city invested and drawing income. In the meantime the fund has increased to $159,000, its present value.

In 1892 Albert D. Bache, a great-great-grandchild of Benjamin Franklin, instituted suit in Philadelphia to have the Franklin trust fund declared invalid, but the petition was dismissed. A similar suit was instituted December 2, 1892, on behalf of the heirs of Elizabeth D. Gillespie and Richard Bache for the same purpose, but this was also dismissed.

It is interesting to note that the Philadelphia Franklin Fund received an addition of $3,000 from John Scott, chemist, of Edinburgh, Scotland. This same Scott also left a sum of $4,000 to Philadelphia to be placed with the same management as the Franklin legacy, the proceeds to be devoted to awarding annually a premium not exceeding $20 and a copper medal with an inscription "to the most deserving." The Franklin Institute now awards annually the John Scott premium and John Scott Medal.

The Boston Franklin Fund now amounts to about $400,000, and its final disposition has been a matter of considerable controversy. A strong effort was made to have the fund applied to the purchase of real estate for an institution somewhat after the lines of the People's Palace of London. Another plan proposed was to devote the fund to the purpose of a trade school modeled after Cooper Institute of New York City. Dr. Pritchett, chairman of the Boston committee, interested Mr. Carnegie and, it was reported, secured an offer to duplicate the fund if devoted to this purpose. The trade unions have opposed this use of the fund and its disposition is yet unsettled, though the indications are that it will be devoted in some manner to the cause of popular education.

Electric and Gas Decisions.

By Alton D. Adams.

A number of typical decisions by the Gas & Electric Commission of Massachusetts were quoted recently, and analyzed by the writer, in the pages of the Electrical World. Below will be found a synopsis of a few cases dealt with in 1905, by various courts throughout the country:

1. Greenfield Gas Co. vs. Trees, Supreme Court of Indiana, June 28, 1905. 75 Northeastern Reporter 2. This was an appeal from an award of damages in the lower court for turning off the supply of natural gas from the residence of Trees. In the complaint there was no direct statement that Trees had complied, or offered to comply, with the reasonable regulations of the gas company at or before the time that his supply of gas was shut off, and a demurrer to this complaint for want of such statement was overruled. This ruling of the lower court was the ground of the appeal. It appeared that after the supply of gas to the residence of Trees was turned off he brought an action to have the supply renewed, and that this action had resulted in a final judgment awarding a writ of mandamus against the gas company. The present action for damages then followed. As to the duty of a natural gas company occupying the streets of a city or town with its mains, the court said that it is bound to supply houses on such streets when the owners or occupants comply with the reasonable regulations of the company. But the failure to allege compliance with reasonable regulations was fatal to the complaint, and the demurrer should have been sustained.

2. Mahan vs. Newton & B. St. Railway Co. Supreme Judicial Court of Massachusetts, Sept. 7, 1905. 75 Northeastern Reporter 59. This was an action by the administration of the estate of J. P. Mahan to recover for the suffering and death of the latter, said to have been caused by electric current from a trolley wire. At the time of the accident Mahan was in the employ of an electric light company, and was at work on a pole that carried several circuits belonging to that company. There was evidence tending to show that no lighting current was in the circuits on the pole where Mahan was at work, and the electric shock that caused his death occurred just as an electric car of the railway approached the scene. It was also in evidence that when the car reached a point near the pole where Mahan was at work the trolley wire was lifted up into contact with the lighting circuits carried by the pole. Near the spot of the accident there were no guard wires over the trolley wire, but it was shown that such guard wires are used on some railways. Mahan did not have on rubber gloves at the time of his injury, though the electric light company for which he worked provided such gloves for linemen, and had a rule that all wires should be treated as live wires. Evidence was admitted to show that with the usual construction a trolley wire would be lifted three or four inches by the passage of a car. After a verdict for the plaintiff in the trial court, the defendant railway appealed on exceptions to the failure of that court to rule that the plaintiff was not entitled to recover, and to the admission of the evidence as to the use of guard wires and the usual lifting of a trolley wire by a passing car. On the appeal it was held that the evidence covered by these exceptions was properly admitted, and that there was no error in the refusal to rule that the plaintiff was not entitled to recover. Whether Mahan was killed by current from the trolley wire, whether it was negligence on the part of the railway company to omit guard wires, and whether Mahan was negligent, were all proper questions for the jury, and the exceptions were overruled.

3.4. Shover vs. Home Telephone Co. Appellate Court of Indiana. October 6, 1905. 75 Northeastern Reporter 288. Shover sued the Telephone Company in the lower court for an injury sustained while unloading a car of telephone poles, and this appeal was brought from a judgment sustaining a demurrer to his complaint. It appeared that the poles were piled eight feet high on a flat car, and were held in position by three standards on each side of the car, and by stay wires that fan between the tops and between points about half way down on each pair of standards, across the car. After the two end standards on the west side of the car had been cut off, and also all of the stay wires except the one attached to the middle of the center standard, and after this center standard had been cut into so as to weaken it near the floor of the car, one Ramsey, who was in charge of the work for the Telephone Company, ordered Shover, who was in the employ of this company, to go to the west side of the car and cut this remaining stay wire. The center standard broke as soon as Shover had cut the stay wire, and the poles fell upon him. Shover was 20 years of age and of average intelligence, but had had no experience in handling telephone poles. On these facts the court remarked that under the employer's liability act an employee asking damages for an injury must have been in the exercise of due care, and held that Shover could not recover because it was negligent for him to execute the negligent order of Ramsey.

The Electrical Distribution System of the Public Service Corporation of New Jersey.—II.

BY G. U. G. HOLMAN.

THE turbine unit in the Coal Street Station in Newark is controlled in the adjacent City Dock station, the generator being classed as belonging to the City Dock station. Thus all units controlled at the Coal Street station are for the railway needs. The sub-stations are fed from this station by 13,200-volt, three-phase cables run in conduits. Central Avenue sub-station has two 1,000-kw, General Electric, 25-cycle, three-phase rotaries, two and one-half miles away from Coal Street, supplying 550 volts direct current.

Railway 550-volt current is supplied by the Coal Street station to the sub-stations at Irvington and Montclair, four miles and seven miles away, respectively. Conduits in the streets of Newark carry 13,200-volt cables to the outlying district and thence the energy is taken overhead on 70-ft. poles. The pictures in Figs. 8 and 9 show the style of conduit and manholes. Lead-covered, paper-insulated, three-conductor cables are used, laid in conduits built up of 3-in. fibre tubes, spaced 4½-in centers in concrete. The manholes and catch basins are rectangular in section, also of concrete. The tops are arched with railroad iron to support the cover and traffic.

The Irvington sub-station contains one General Electric, 1,000-kw, three-phase, 25-cycle rotary and one 500-kw, General Electric, three-phase, 25-cycle rotary, both for railway 550-volt, direct-current. This sub-station contains five 17½-kw, constant-current transformers used for incandescent street lighting distribution, receiving its energy from the City Dock station at 2,200 volts, 60 cycles.

Montclair sub-station contains three 500-kw, General Electric, three-phase, 25-cycle rotaries, receiving their energy from Coal Street station at 13,200 volts alternating current and supplying 550 volts direct current for railway use. In this sub-station is also 2,500 kw in General Electric, two-phase, 60-cycle, air-blast transformers, 13,200-6,600; 2,400 volts for lighting.

The City Dock station in Newark is a lighting and power station. The apparatus consists of seven Westinghouse 850-kw, 2,300-volt, two-phase, 60-cycle generators, each direct-connected to a Pennsylvania Iron Works horizontal, cross-compound, condensing engine, and one Westinghouse 500-kw, 550-volt, direct-current generator, direct-connected to a Watts-Campbell horizontal cross-compound condensing engine. There are seven 500, two 600 and four 800-hp Climax boilers at 150 lb. pressure. This station up to a year ago contained arc lighting machines that were thrown out by the present use of alternating-current arc lamps. The City Dock station, besides supplying the Irvington and the Montclair sub-stations in common with Coal Street, supplies Mechanic Street sub-station, which is solely used for power supply, and the following street lighting transformer stations: Bloomfield Avenue, two and one-half miles away; Bergen Street No. 1 and Bergen Street No. 2, 8,000 ft. apart and three and two miles from the station; East Newark, two miles away; Belleville, four miles away, and Lyndhurst, eight miles away from the station.

The Mechanic Street sub-station contains three 300-kw Westinghouse, 2,300-volt, two-phase and one 300-kw, Westinghouse, 2,300-volt, three-phase transformers, all 60-cycle and used for commercial power circuits.

The Bloomfield Avenue sub-station contains three General Electric, 71-kw, 60-cycle, single-phase, 2,400-volt, tub transformers for supplying 7½ amp. street arc lights.

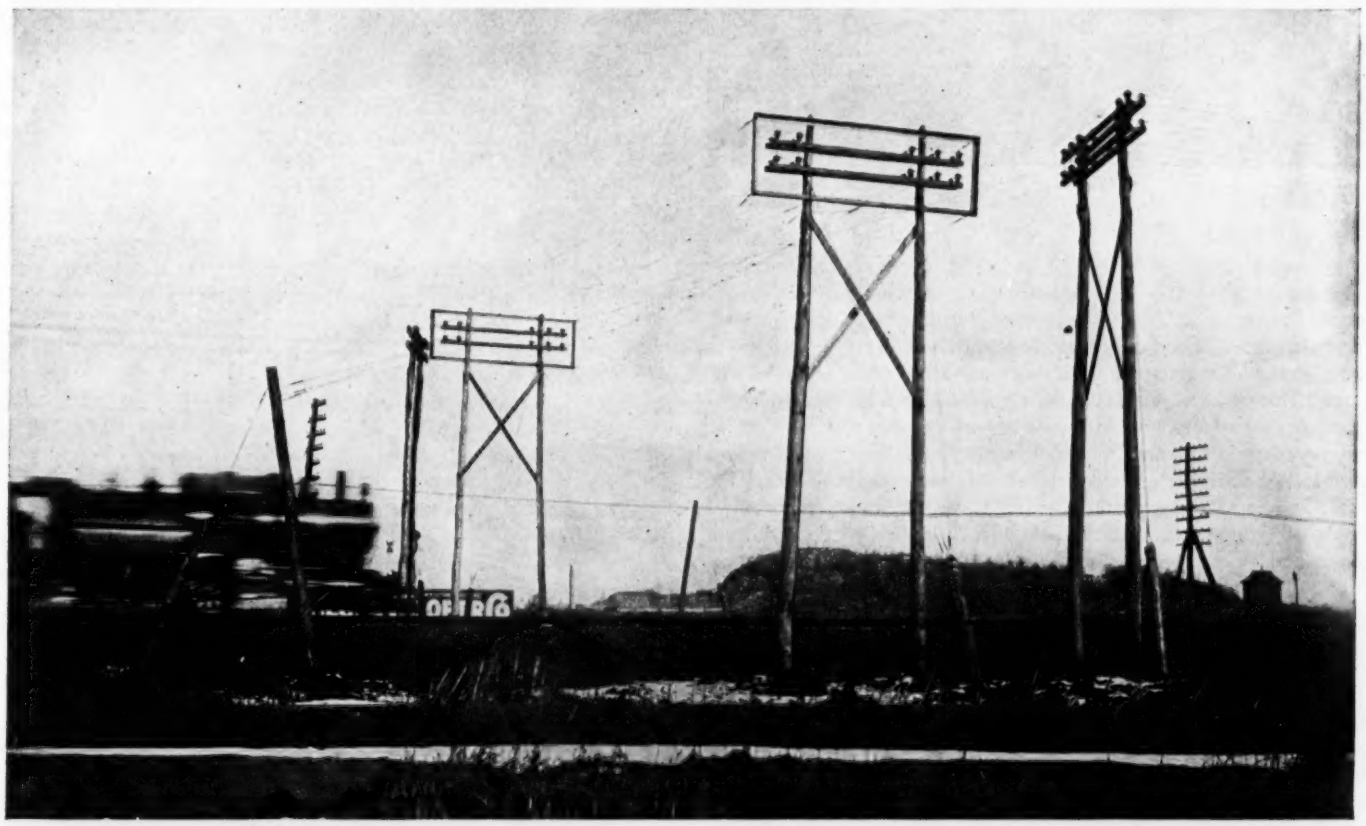


FIG. 5.—SHOWING WIRE CAGE GUARD ON THE SIDES OF AND BENEATH THE 13,000-VOLT TRANSMISSION LINES AT A PENNSYLVANIA RAILROAD CROSSING.

Bergen Street No. 1 and No. 2, respectively contain three and four General Electric 100-light, 2,400-volt tub transformers, supplying 7½ amp. to street arc lamps. The East Newark and the Belleville sub-stations each contain three General Electric, 100-light, 7½-amp., 2,400-volt tub transformers used for both arc and series incandescent street lighting. Lyndhurst sub-station contains one 17½-kw, 2,200-volt, General Electric tub transformer used solely for series incandescent street lighting.

An examination of the map (Fig. 2, last issue) of the district supplied by Coal Street and the City Dock stations with both light, power and railway service, reveals the fact of the present abandonment of the generating stations at Orange and South Orange, and the installation of two sub-stations; one at Lincoln Ave., to take the Orange station load, and one at Belleville, to fill the increased requirements for railway and lighting in that section. The South Orange station's load is to be divided between the present two sub-stations at Central Ave. and at Irvington. The apparatus in the to-be-discarded Orange station consists of a line shaft

belted to one horizontal, cross-compound, Watts-Campbell, high-pressure engine, and one Hewes & Phillips horizontal, cross-compound, low-pressure engine. The boilers are three 600-hp Climax, run at 140 lb. The shaft is belted to three Westinghouse generators and one General Electric generator of a total capacity of 690 kw supplying 500 volts for power and railway; two two-phase Stanley, 2,600 volts, 60-cycle, 275 kw each for lighting, and 256 kw of arc lighting generators, Brush and Thomson-Houston. As a present temporary sub-station supplied by City Dock station

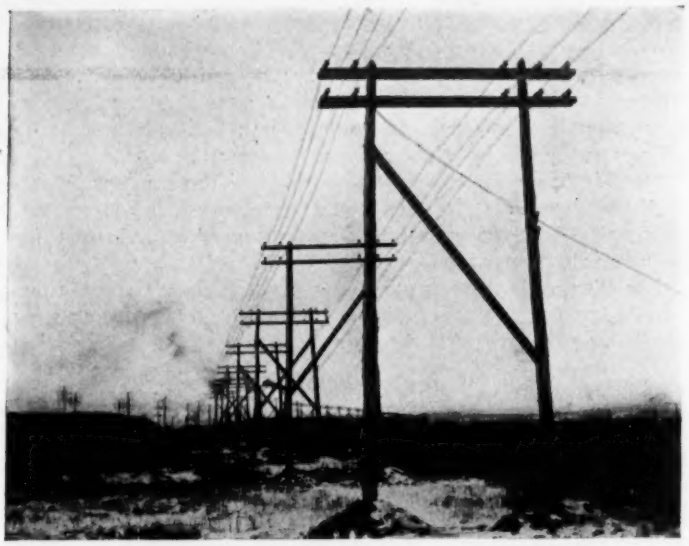


FIG. 6.—TRANSMISSION 13,000-VOLT LINES ACROSS THE JERSEY MARSHES, CONNECTING MARION STATION WITH NEWARK PLANTS.

there are installed 6,600-volt transformers consisting of eight 100-kw, two to three-phase, 60-cycle, Wagner oil type; three 50-light, General Electric, 2,200-volt, 6.6-amp. tub transformers; two 17½-kw, General Electric tub transformers for series incandescent street lights, and three 21½-kw, General Electric voltage regulators, used for series incandescent street lights.

By a further examination of the map showing the Northern New Jersey distribution it will be readily seen what an important part the new Marion station will play in the more economical supply of light, power and railway energy in this section. Grand Street and Wayne Street stations, two old, small unit stations, and one sub-station (Communipaw), are to be replaced by the new sub-station (Pennsylvania) in this same district, and the present tie-feeders connecting the three sets of apparatus with the Hoboken Fourteenth Street central plant will be taken out.

The Grand Street station contains nothing but railway generators of 500 volts direct current. There are six Westinghouse, 175-kw generators, each belted to Ball & Wood high-speed compound condensing engines; one General Electric 525-kw generator and two Westinghouse 375-kw generators, each direct-connected to an Allis horizontal cross-compound condensing engine. There are five Heine and six Babcock & Wilcox boilers of 250 hp each run at 125 lb.

Wayne Street is also an old plant, consisting mainly of slow-speed engines belted to a jack shaft and operating about 1,195 kw in four units at 2,600 volts of Stanley generators; 400 kw emergency railway generators of two 200-kw Westinghouse each; 620 kw of 550-volt power generators in three units, and about 1,200 kw of direct-current Brush & Wood arc lighting machines. The engines are Watts-Campbell and George H. Corliss horizontal cross-compound and two tandem compound Mackintosh & Seymour, to which some of the generators are belted direct. The boilers are three 500 and two 600-hp Climax, run at 150 lb. pressure.

Until the Marion station and the new Pennsylvania sub-station are actually in service, Wayne Street station contains also one Westinghouse 300-kw, 6,600-volt, 550-volt, 60-cycle rotary, used for power service and fed from the City Dock station at Newark through the feeder across the Hackensack meadows, built over a year ago in anticipation of future use by the new Marion plant. This tie consists of three feeders, each of three 2-0 copper, stretched across the Hackensack marshes on two cross arms supported by two poles, as shown in Fig. 6. Where the feeders run under the Passaic and Hackensack Rivers three-conductor, lead-covered, iron-armored and paper-insulated cables, are used. There are cable and lightning arrester houses, as shown in Fig. 7, on both sides of the Hackensack River and on the east side of the Passaic. Three-conductor, 2-0, lead-covered, paper-insulated cables, are run underground from the east cable house to the Marion power house. There are also in Wayne Street eight 100-kw Wagner, oil-cooled, 6,600-2,400-volt transformers, used for commercial incandescent lighting as step-down transformers from the Newark station. The concentration of service supply for railway and lighting to the Pennsylvania sub-station and the abandonment of the comparatively uneconomical plants of Wayne Street and Grand Street will make for economy in copper and in kw-hour cost.

The discarded Communipaw sub-station contained one Westinghouse 300-kw, 6,600-volt, 60-cycle, two-phase rotary, giving 550 volts direct current for power purposes fed from Wayne Street station. The Grand Street plant did not feed any sub-station.

Two new sub-stations, "Junction" and "Bayonne," will be fed from the Marion station and will contain rotary units of 1,000 kw for railway supply and step-down static transformers for lighting.

The Palisade Avenue plant has been shut down since last spring and consisted of small generators belted to jackshaft and slow-speed engines. The Palisade sub-station, temporarily fed from Coal Street and Secaucus, will be fed entirely by the Marion plant and consists of three 1,000-kw, three-phase, 25-cycle, General Electric, 13,200-volt-550-volt, direct-current rotaries for railway and two 500-kw, three and two-phase, 60-cycle, 13,200-2,600-volt, oil Westinghouse transformers, fed from City Dock station, Newark.

The Secaucus plant is temporarily connected with four sub-stations—Palisade Avenue, New Durham, Hackensack and Passaic—with 13,200-volt, 25-cycle energy for railway distribution. The plant contains one three-phase, 25-cycle, 13,200-volt, General Electric, 1,800-kw generator direct-connected to an horizontal

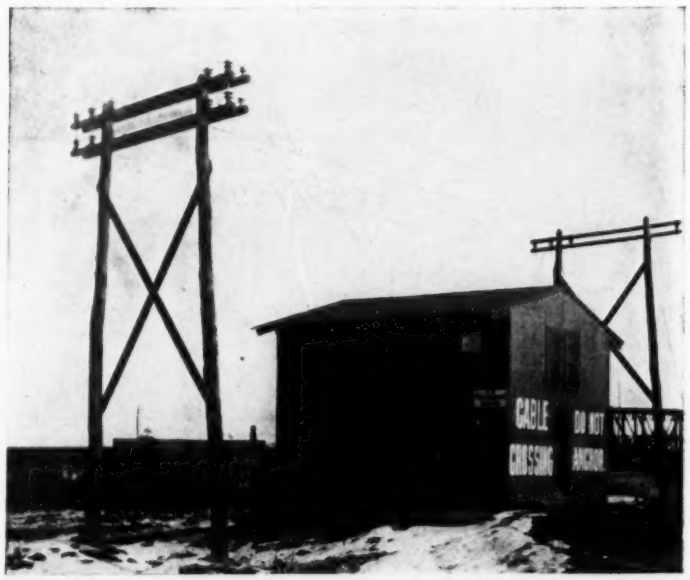


FIG. 7.—AËRIAL 13,000-VOLT TRANSMISSION LINE CONNECTING WITH HACKENSACK RIVER CABLE WITHIN CABLE BUILDING.

compound Brown Corliss condensing engine; two three-phase, 25-cycle, 13,200-volt General Electric 400-kw generators, each direct-connected to an horizontal compound condensing Watts-Campbell engine; three direct-current, 550-volt, Westinghouse railway generators, driven by a Pennsylvania Iron Works horizontal cross-compound, condensing engine; and a 300-kw, General Electric, 13,200-volt, 25-cycle rotary. The boilers are two 500-hp and four 250-hp Babcock & Wilcox, at 200 lb. pressure, and four 320-hp Climax at 200 lb. pressure, run at 125 lb.

The Palisade Avenue sub-station is fed also from Coal Street station and has previously been described. The New Durham

sub-station contains two General Electric, 1,000-kw, 13,200-volt, 25-cycle rotaries giving 550 volts direct current. The Hackensack sub-station contains two 300-kw, General Electric, 13,200-volt, 25-cycle rotaries feeding 550 volts direct current. This sub-station can also be fed from the Marion and the Coal Street plants by way of Secaucus station and Palisade Avenue sub-station, as the Secaucus bus can be tied in to the Coal Street plant. The Passaic sub-station contains one 1,000-kw and one 300-kw, General Electric, 13,200-volt, 25-cycle rotary, giving 550 volts direct-current for railway service. Passaic sub-station, feeding from Secaucus, can also be fed from the Marion and Coal Street plants. The capacity in 13,200-volt, 25-cycle generating apparatus given by the Marion station permits the shutting down of the Passaic generating plant, as the Passaic sub-station contains also step-down lighting equipment supplied from the Paterson plant as follows: Two Wagner 100-kw, 6,600-2,600-volt, two-phase, 60-cycle, oil-cooled transformers; two General Electric transformers of like capacity and style, and one Stanley 2,000-1,000, 60-kw, single-phase, 133-cycle transformer used for incandescent street lighting.

The Paterson plant, as soon as changes can be made, will naturally go the way of small unit plants, but cannot be spared for some time to come. It contains many small units as follows: One pair of 100-kw and four pairs of 200-kw, General Electric, 135-volt, direct-current generators, feeding a direct-current incandescent service, and four pairs of 225-kw, 550-volt, direct-current and one pair of 235-volt, direct-current generators for railway supply. Each of the ten pairs of the foregoing sets is direct-connected to a vertical Ball & Wood condensing engine. Two vertical Ball & Wood condensing engines drive a line shaft to which is belted three 100-kw, General Electric, 500-volt, direct-current generators for railway service; one 150-kw, 1,200-volt and one 300-kw, 2,400-volt, Stanley, two-phase, 133-cycle generators, and twelve Brush arc generators of 100 lights each. The boilers are ten 500-hp Stirling at 160 lb. pressure. Three 100-kw, Wagner, 60-cycle, 6,600-2,400-volt, and two 100-kw, one, two and three-phase, 60-cycle, 6,600-2,400-volt, General Electric transformers are in use, stepping up to the 6,600-volt line to the Passaic sub-station.

The Hackensack plant consists of two Stanley inductor type, 1,000-kw, 2,500-volt, 66-cycle, two-phase generators, and one Stanley, 825-kw, 66-cycle, two-phase generator, each direct-connected to a vertical cross-compound Mackintosh & Seymour con-

FIG. 8.—DUCT CONSTRUCTION, STREETS OF NEWARK.

densing engine. There are four 300-hp Stirling and two Hogan water-tube, 350-hp boilers at 150 lb. pressure. This station will be shut down and at present has as sub-station apparatus eight General Electric Company 100-kw, 60-cycle, 2,200-6,600-volt transformers, one pair as a spare unit and each of the other pairs supplying the present lighting sub-station at Rutherford (which will be abandoned), and Englewood and Ridgewood. The lines for the eastern section of this territory are cabled under the Hackensack River in submarine cables. Cable houses supplied with cable switchboards are at the points where the cables enter and leave the river. As extra cables are laid, damaged cables can be readily cut out and perfect ones cut in. The cable house switches make it convenient for the testing of grounds. The transmission line to Ridgewood is eleven miles in length, the Rutherford line six miles and the Englewood line seven miles.

The Ridgewood sub-station contains three 75-kw, General Electric, single-phase, 60-cycle, 6,600-2,200-volt transformers, one being a spare. Commercial lighting and street series incandescent circuits are fed over a wide suburban district. The Rutherford sub-station contains five 75-kw, General Electric, single-phase, 60-cycle, 6,600-2,200-volt transformers, one being a spare. They

FIG. 9.—CONCRETE MANHOLE CONSTRUCTION.

supply commercial and incandescent street lighting. Two General Electric tub transformers of 14 kw each supply series arc lights. The Englewood sub-station contains three Stanley, 6,600-2,200-volt, 60-cycle, 50-kw transformers and one General Electric of like capacity and type, which with one Stanley transformer is reserved as a spare unit. There are also two General Electric, 30-kw, 6,600-3,000-volt, tub transformers for arc street lighting. These three sub-stations will be fed from the Marion plant and a new sub-station called the Hudson River is to be erected part way between Englewood and New Durham, which will give a better distribution of circuits.

The Hoboken plant at Fourteenth Street and the Hudson River will be retained, as all its capacity is required in the immediate vicinity. The district is rich in possibilities for power distribution. The present tie line with Jersey City at the Wayne Street station is to be dispensed with and the Hoboken plant relieved of this portion of its load, will permit the plant to better care for its own requirements for several years to come. The plant contains three Stanley inductor type, 750-kw, 60-cycle, two-phase, 2,600-volt generators. Two are direct-connected, each to a Providence Corliss cross-compound, horizontal, condensing engine, and one to a Pennsylvania Iron Works cross-compound, horizontal, condensing engine. There are three 850-kw, direct-current, General Electric, 550-volt generators, each direct-connected to a Pennsylvania Iron Works cross-compound condensing engine. There is one Westinghouse 300-kw, 2,600-volt, two-phase, 60-clcle rotary, giving 560 volts for power work. Four alternating-current Stanley, two-phase induction motors of 200 kw each are connected on the same shaft with a pair of Brush 100-light, alternating-current arc machines. There are eight 520-hp Babcock & Wilcox boilers at 150 lb. pressure.

There are two small independent plants in this Northern New Jersey section which are planned to remain owing to the difficulty in securing right of way for the necessary high-tension pole line. These are Morristown and Boonton, each situated about sixteen miles in an air line from the nearest central station at Newark, and about eight miles from each other. Both are lighting plants. Morristown contains two 120-kw and two 150-kw General Electric, 60-cycle, single-phase, 1,100-volt generators, belted to three Ball & Wood cross-compound, non-condensing engines. There are three 250-hp Hazelton vertical tubular boilers at 130 lb. pressure. At the Boonton station are two Stanley 90-kw, 1,200-volt, two-phase, 60-cycle generators, each belted to a Ball & Wood simple non-condensing engine. There are two Bigelow horizontal boilers of 125 hp each at 100 lb. pressure.

The Elizabeth plant is six miles from Newark and contains

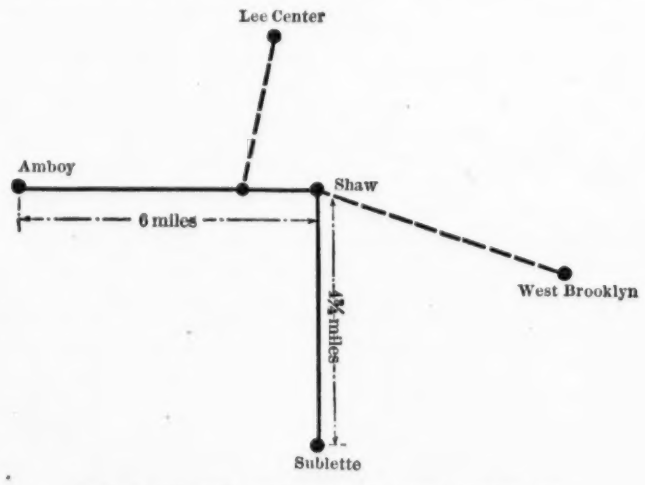
two General Electric 525-kw, 550-volt, direct-current railway generators, both direct-connected, one to a Watts-Campbell and the other to a Providence Corliss horizontal cross-compound condensing engine. There is also one 120-kw and two 300-kw, one, two and three-phase, 60-cycle, General Electric, 2,300-volt generator, belted to a line shaft; one 225-kw, General Electric, 550-volt, direct-current railway generator, also belted to the line shaft and sometimes used as a motor to drive the line shaft; two 25-kw and two 45-kw Edison bipolar generators, 125 volts, belted to the line shaft, and about 225 kw of Brush and Thomson-Houston arc machines belted to this same line shaft. This shaft is driven by a 400-hp Pennsylvania Iron Works, horizontal, compound condensing engine. This station also contains four Wagner, 6,600-2,400-volt, single-phase, 60-cycle, self-cooled, 250-kw transformers, used for stepping down from the City Dock station, Newark. There are also two Stanley, 25-kw, 2,400-500-volt, single-phase, 60-cycle, transformers used for a teaser connection. The boiler capacity consists of six 250-hp Babcock & Wilcox boilers and two 150-hp horizontal tubular Stewart boilers, all at 150 lb. pressure.

The Elizabeth plant is having a tie line installed connecting with the Rahway sub-station and through this to the Metuchen plant. The Cranford plant is wholly for railway supply, is about 4½ miles from Elizabeth and contains two Westinghouse 800-kw, 600-volt generators, direct-connected to a Williams vertical cross-compound condensing engine. There are nine 150-hp horizontal tubular Stewart boilers at 160 lb. pressure.

There is a 600-amp. storage battery at Orange for railway feed built by the National Storage Battery Company, one at Paterson of 700 amp. capacity, built by the Electric Storage Battery Company, used to supplement direct-current incandescent lighting, and a power battery of 500 volts of 1,000 amp. capacity, at Mechanic Street.

District Supply Near Amboy, Ill.

The Amboy Lighting & Power Company recently placed in operation a transmission line 10¾ miles long between Amboy, Ill., and Sublette. Amboy is a town of about 2,200 population and the population of Sublette is about 800. The company at Amboy recently rebuilt the electric lighting plant there. The lighting distributing system at Sublette which was recently put in



MAP OF DISTRICT SUPPLY LINES NEAR AMBOY, ILL.

is operated at 250 and 125 volts on a three-wire secondary system directly off the terminals of the step-down transformer, the primary of which is supplied over the transmission line at 6,600 volts. The transmission line and distribution system in Sublette called for an investment of about $6,000.

The transmission line on the way to Sublette passes through the village of Shaw, as indicated by the accompanying map, at which point a small amount of lighting is done. It is the intention to build a branch line to Lee Center and also to continue the line now running through Shaw to West Brooklyn, thus supplying in all four villages besides Amboy. The pole line is constructed with No. 8 hard-drawn copper wire on 30 ft. poles, having 6-in. tops. Standard 2-pin cross-arms, double braced, were employed. The step-up and step-down transformers are 30-kw Kuhlman.

No regular employee is maintained at Sublette. Arrangements are made with a telephone man at Sublette to switch the street lighting circuit on and off and to answer minor trouble calls. The street lighting in Sublette is done with 20-cp. multiple incandescent lamps.

The station at Amboy which has been reconstructed is a substantial little building containing two Warren alternators, one of 65-kw capacity and one of 80-kw. These are both 60-cycle machines, driven by high speed engines. There are two 100-hp horizontal return flue boilers. The building is of brick with asbestos composition roof and cement floors in the boiler room, making it practically fireproof.

The engine room floors are hard wood. Most of the lines in Amboy have been rebuilt and the transformer system has been thoroughly overhauled, replacing small with large transformers and bunching as many customers as possible on each transformer. The service was formerly very unreliable and unsatisfactory, owing to the run-down condition of the plant. Since the present owners took hold of the property and rebuilt it, there has been an increase of nearly 100 per cent in the gross income. Most of this has been due simply to the better service given. The rates are 15 cents per kw-hour.

The transmission line is located on the highway, for which the consent of abutting property owners and a franchise was secured.

Central Station Economics in Massachusetts.— III.

UNITED ELECTRIC LIGHT COMPANY, SPRINGFIELD.

This company was organized in 1886, and it does a general power and lighting business in Springfield, West Springfield and Long Meadow, serving a population of about 75,000, according to the State census of 1905. Its officers are: President, Robert W. Day; treasurer, W. A. Lincoln; general manager, W. L. Mulligan. The company's general offices are at 133 State Street, Springfield, and there are three power stations, one being located at Indian Orchard, a second at Birchem Bend and the third at the foot of State Street in Springfield, on the east bank of the Connecticut River. These plants have been described in detail in these columns and a mere résumé of their equipment will be given below.

The Indian Orchard plant was one of the first hydro-electric stations to be placed in commercial service in Massachusetts. It is located about seven miles east of Springfield on the Chicopee River and at present contains five McCormick turbines, one Westinghouse, 600-kw, direct-connected, revolving-field alternator, four Stanley, 400-kw alternators of the inductor type; eleven Brush

INCANDESCENT LIGHT — SPRINGFIELD, MASS., Dec. 1st, 1905

FOR ELECTRICITY CONSUMED FROM OCT.		TO NOV. 1905.		
READING OF METER	950	10 MAXIMUM DEMAND		
LAST READING	1000	20 KILOWATTS AT 10 CENTS	3	60
DIFFERENCE	50	30 KILOWATTS AT 8 CENTS	2	40
CONSTANT	1	MINIMUM CHARGE		
TOTAL	50	TOTAL	6	00

Receipt of payment for the Company,

FIG. I.—RECORD OF CONDITION OF CIRCUIT.

arc machines of 140 lights each, and two Westinghouse, 500-kw rotary converters for railway or power service. The alternators are all built for 60 cycles and generate current at 5,500 volts, which is transmitted to Springfield by two two-phase circuits. The Brush arc machines are employed in the street lighting service, the current for this work also being transmitted to Springfield. Recording ammeters are used on the arc switchboard at the Springfield end of the line to enable the attendants to keep a closer watch upon the performance of the machines than is possible with ordinary indicating ammeters, and to provide a convenient and reliable record of the condition of the circuit at

all times. These records are often of use in checking up outage claims from the city after fires or other casualties, and it has frequently happened that by their use the attendants at Springfield have discovered operating irregularities before the Indian Orchard attendants have noticed them on the spot, so that a telephone call has sufficed to remedy the situation.

The Birchem Bend plant contains two Westinghouse, 475-kw, 5,500-volt, 60-cycle, two-phase alternators, direct-connected to McCormick turbines. It is located about two miles from Indian Orchard and is connected with the latter plant by a tie line. From Birchem Bend to Springfield a five-mile line extends, completing the triangle of connections, so that both Indian Orchard and Birchem Bend can supply Springfield directly or through each other. This flexible arrangement is of great value in insuring reliable service.

The Springfield plant is used in part as a generating station and in part as a sub-station, depending upon the amount of water available at the hydraulic plants. It contains five 400-hp and three 300-hp Hazelton upright boilers, equipped with Murphy furnaces to comply with the smoke laws. Each boiler has its own chimney in order to secure adequate draft and economy of space. All exciter sets and condensing apparatus are steam-driven. There are three 1,000-kw Westinghouse-Parsons steam turbines direct-connected to alternators, five Brush arc machines for commercial lighting, one General Electric 500-kw, 500-volt, direct-current generator, one Westinghouse 500-kw rotary converter and a 475-kw synchronous motor used in times of good water supply to drive the Brush arcs and a 500-volt General Electric generator. These latter are driven by an 800-hp Corliss engine when the water supply is inadequate.

Coal is handled at Springfield by an electrically-operated locomotive crane with a grab bucket which takes the fuel from the railroad cars and delivers it to a motor-driven coal crusher, whence it passes to weighing apparatus, and then to shunts leading to a belt conveyor which finally deposits it in bins above the boilers. Gravity feed to the furnaces follows. The ashes will be handled by a belt conveyor as soon as it is feasible. All the power plants are equipped with hand-operated cranes to facilitate inspection and repairs, removals or additions of machinery. Georges Creek coal is burned, costing about $4.75 per ton. Daily records are kept of the coal consumption per kw-hour, which averages about three pounds. The boilers are banked or allowed to become cold according to water conditions. On the average three boilers are ready for emergency service.

The total number of kw-hours generated by the plants of the company during the year ending June 30, 1905, was 11,331,299. Of this output, the water power plants supplied 63 per cent and the steam plant at Springfield the balance. The cost of manufacture has been reduced by the removal of belted units at Indian Orchard and Springfield, by the installation of a modern coal-handling system at the latter point in place of the laborious hand methods previously employed, and by the installation of steam turbines, which improve the load factor by their well-known operating economy at fractional outputs. The wiring at Indian Orchard has been thoroughly modernized and all the plants put in the basis of concrete construction.

The operating economy of the power plants is kept track of by regular wattmeter readings, records of coal consumption, labor cost, water meters and recording gauges at the hydraulic stations. The power house force is organized on the basis of first-class wages and eight-hour shifts.

Incandescent lighting is carried out on single-phase circuits of 1,200 and 2,400 volts, and street lighting by 5-amp., direct-current Brush arcs. Power is supplied in quantity where desired by a two-phase, 5,000-volt circuit, the high potential being carried as far as the consumer's premises. There is also a 500-volt, direct-current power circuit available. On June 30, 1904, about 25 miles of underground conduit were in service, and this is being increased at the rate of about five miles per year. Circuits are tested for grounds or excessive losses at least once a week. To improve the economy of distribution, small house-to-house transformers are very largely being superseded by large transformers with grouped residential and commercial loads. These large transformers are frequently placed in manholes, with three-wire secondary leads feeding the street on each side. The cost of maintaining distributing lines has been considerably reduced by the installation of the underground system and also by replacing air-cooled or "dry" transformers by the oil-cooled type. Special care is also taken to keep the pole lines in first-class condition. The telephone is used throughout all the system, private wires being run at the company's expense to the homes of all responsible employes. The policy of the company in regard to connecting up loads located outside the main distributing

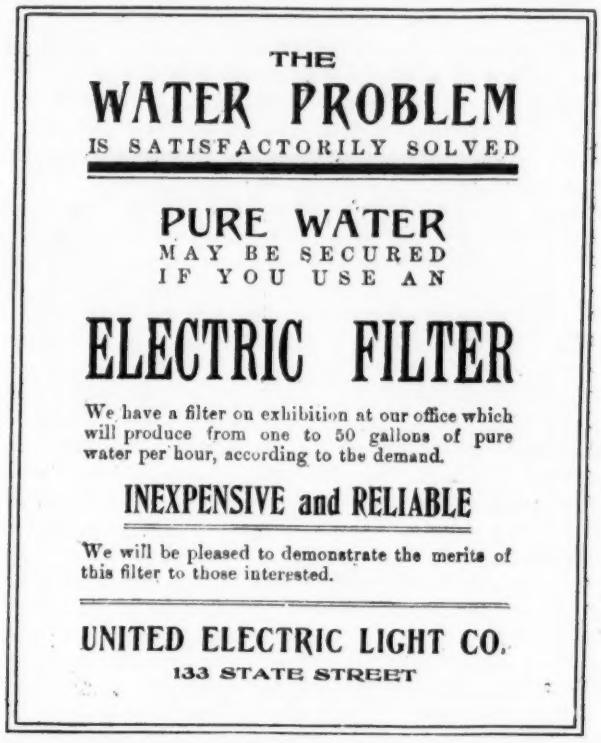

THE
WATER PROBLEM
IS SATISFACTORILY SOLVED
PURE WATER
MAY BE SECURED
IF YOU USE AN
ELECTRIC FILTER
We have a filter on exhibition at our office which will produce from one to 50 gallons of pure water per hour, according to the demand.
INEXPENSIVE and RELIABLE
We will be pleased to demonstrate the merits of this filter to those interested.
UNITED ELECTRIC LIGHT CO.
133 STATE STREET

FIG. 2.—EXAMPLE OF ADVERTISEMENT.

system varies according to the investment in new equipment required, but in general it may be said that no new business is refused, however far it may be from the center of distribution. If the territory is undeveloped, the customer may be asked to bear a share in the extra investment required to meet his conditions, but the arrangements in such cases admit of no specific classification. The terms of each contract naturally depend upon the problem in hand, but as the territory develops and becomes profitable, the conditions usually are found to grow more favorable to the original customer, leading to the possible refunding of his pro rata share in the primary extension.

Portable watt-hour meters are used in making service tests

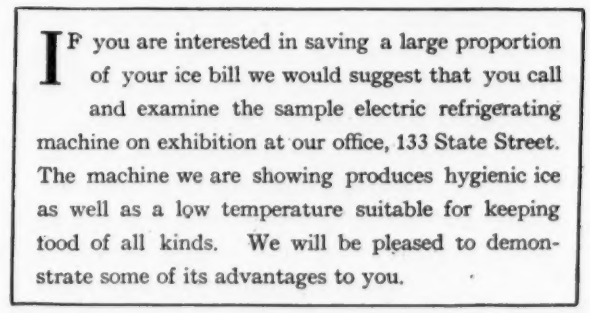

IF you are interested in saving a large proportion of your ice bill we would suggest that you call and examine the sample electric refrigerating machine on exhibition at our office, 133 State Street. The machine we are showing produces hygienic ice as well as a low temperature suitable for keeping food of all kinds. We will be pleased to demonstrate some of its advantages to you.

FIG. 3.—EXAMPLE OF ADVERTISEMENT.

of consumers' meters. Card index records of meters, pole locations, underground services and customers are constantly maintained in the office, and drawings and data are filed alphabetically in a special safe. The addressograph and the adding machine are also in the office.

The United Electric Light Company advertises extensively in the local newspaper, changing the text of its "write-ups" from time to time as circumstances dictate. Special efforts are made to point out in terse, pithy language the broad economy, clean-

liness and convenience of electricity in all its applications. The practice of variety in the advertisements is fostered by the almost numberless applications of electricity which the central station supplies. Two examples of advertisements are shown in Figs. 2 and 3.

Circular letters are sent to customers as occasion warrants, and neat circulars bearing upon the all-around usefulness of electricity are constantly kept before the public eye in the company's offices, on tables, beside the cashier's window, etc. Customers are also solicited by two men who devote practically all their time to getting new business. An excellent exhibit of electrical appliances is maintained by the company at its general offices. These are located on the ground floor at 133 State Street, and the front of the premises is bounded by two large windows filled with electric heating or other equipment of interest to the general public. Inside are set up ready for operation at will electric radiators, flatirons, stoves, coffee pots, a cigar lighter, small motors and an electric filter. Besides the latter are shown two bottles of Ludlow water before and after treatment, and a report by an expert chemist of Springfield showing that in a certain case the sample of water before filtration contained from 4,000 to 11,000 bacteria, and after filtration from 16 to 140 bacteria only, a reduction of from 97 to 99.8 per cent. A refrigerating machine driven by a ½-hp, 110-volt, three-phase induction motor is also shown, and the walls are hung with a number of excellent photographs of the company's power plant exteriors and interiors. The stock room is located on this floor and is brilliantly lighted by Nernst lamps. "Meridian" lamps are also used in the office. On one of the walls is a panelboard upon which are mounted lamps varying from 2 cp to 50 cp in size, wired up for service. Adjoining each lamp is a statement of the cost per hour at the regular rates, as follows:

Cost per Hour at Regular Rates.

1/10c.	2/10c.	39/100c.	45/100c.	51/100c.	9/10c.	1 3/10c.	1 8/10c.	3 1/10c.
2 cp.	4 cp.	6 cp.	8 cp.	10 cp.	16 cp.	25 cp.	32 cp.	50 cp.

The rates of the United Electric Light Company for incandescent service are special for very large customers, but in general they are based upon the "Wright Demand" system. Twice the maximum demand reading is charged at 18 cents per kw-hour and the excess at 8 cents. A sample bill is reproduced herewith (Fig. 1). The rates for motor current vary from $50 minimum yearly charge for 1-hp motor to $600 minimum for the 25-hp and 30-hp sizes; the charge per kw-hour varies from 5 cents in 2-hp to 5-hp motors to 3¼ cents in 25 or 30-hp motors. Electric sign current costs from 6 to 8 cents per kw-hour, on a separate meter, and current for electric heating costs from 3 to 5 cents per kw-hour on a separate meter. No discounts are used.

Gas competition is met by furnishing a better illumination at fair rates. The gas arc has been vanquished in many cases by the use of the Nernst lamp, or by clusters of "Meridian" lamps with pagoda shades. Free incandescent renewals are made by the company, and in new installations the company provides meters and lamps without charge. Customers buy their own motors. Over 500 alternating arc lamps of the enclosed type are in commercial service. No apparatus is rented to customers and the company's inspectors are all uniformed. The window lighting business has become very highly developed in Springfield and electric signs are largely used.

Single-Phase Equipment for the St. Clair Tunnel.

Last week we made note of the fact that St. Clair Tunnel Company had adopted single-phase locomotives for the operation of trains through the Sarnia tunnel, and mentioned a few of the general features of the installation. We are now able to give a more detailed account of the locomotives and the power equipment. There will be six locomotives, each of which will be mounted on three pairs of driving wheels which will sustain the entire weight distributed by equalizer bars similar to those used in steam locomotive practice, will have an outside frame supported on semi-elliptical springs, and will be equipped with Westinghouse friction draft gear, MCB automatic couplings, air sanding apparatus, and bumper steps, front and back. The cab will be of sheet steel mounted on a framework of iron which supports both walls and roof.

The principal dimensions will be approximately as follows: Length over end sills, 27 ft. 9 in.; rigid wheel base, 12 ft. 0 in.; width over all, 9 ft. 6 in.; height from top of rail to top of cab, 12 ft. 6 in.; diameter of driving wheels, 62 in.

The operating apparatus will be arranged along the sides of the cab, leaving a free passageway 3.5 ft. wide the entire length. The cab will be lighted and heated by electricity.

Westinghouse combination automatic and straight air and

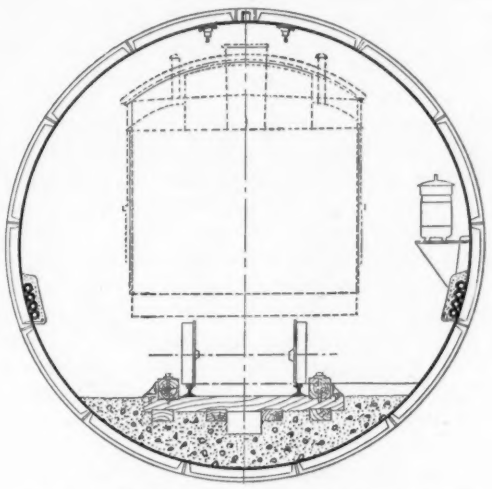


FIG. 1.—CROSS-SECTIONAL VIEW OF TUNNEL.

American driver brakes will be used. The air supply will be provided by a two-cylinder motor-driven air compressor. A motor will be geared to each axle, giving each unith an aggregate rated capacity of 750 hp. The motors are of the Westinghouse single-phase, series-wound, compensating type. Each motor will weigh complete approximately 14,500 pounds, the armature weighing approximately 5,600 pounds.

The motor frame consists of a steel cylinder cast in one piece and enclosed at the end by brackets of the same material, which carry the bearings and oil reservoirs. The suspension noses and

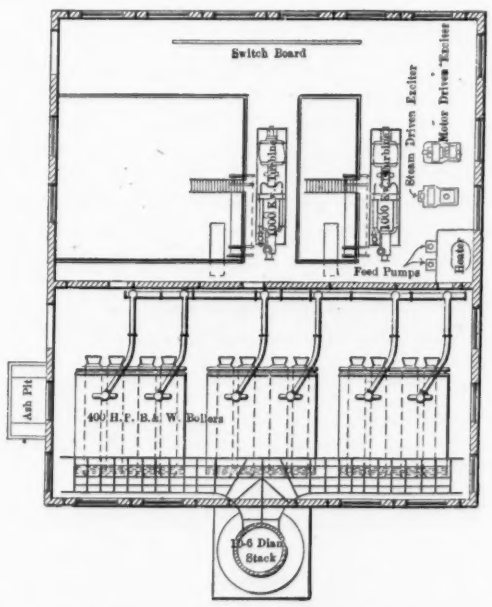


FIG. 2.—GENERAL PLAN OF POWER HOUSE.

safety lugs form a part of the main casting. Seats for the axle bearings are cast solid with the frame. Bearings are of phosphor-bronze lined with babbitt, and each is divided into two parts. They are of exceptionally large dimensions, and are arranged for oil waste lubrication. The motors are swung between the locomotive frame and the driving axles by a flexible nose suspension from two hangers supported by a truck transom and

passing through heavy lugs with helical springs above and below the lug. The motors are held to the axle by means of caps which are split at an angle of 35 deg. with the perpendicular, so that the greater part of the weight is borne by solid projections from the motor frame which extend over the axle rather than by the cap bolts. Large openings above and below provide access to the commutator and brush holders.

Within the cylinder of the motor frame there is built up a core of soft-steel punchings, forming a complete laminated field core. The punchings are dovetailed into the frame and clamped between end rings of cast steel. The field coils are wound with copper strap insulated between turns and around the coils by mica, and are finished by taping and dipping, and are impregnated in the best grade of varnishes, providing a sealed coil which can withstand the most severe internal heat, and is practically indestructible under the usual conditions of heavy railway service.

In addition to the main coils the field core carries a neutralizing winding which consists of copper bars placed in slots in the pole faces and joined at the ends by connectors of copper strap, so as to form one continuous winding which is connected in series with the main field winding and with the armature circuit. The magnetizing effect of this auxiliary winding is directly opposite to and neutralizes that of the armature winding, thus eliminating the effect of armature reaction and improving the commutation and the power factor. The main coils can be easily removed without disturbing the auxiliary winding.

The armature cores are formed of slotted soft steel punchings built up upon a spider and keyed in place. The spider is forced upon the shaft with heavy pressure and secured by a steel key. Coils of copper strap are embedded in the slots and joined to form a closed multi-circuit winding which is cross-connected, like the multi-circuit winding of a direct-current generator. The basis of the insulation is mica. A preventive resistance is connected between the commutator and each main coil, introducing a preventive action which is effective only when the coil is passing under the brush.

During operation a forced circulation of air supplied by motor-driven blowers enters at the rear, distributes itself thoroughly throughout the motor and escapes through the perforated cover over the commutator. This system of forced ventilation of both motors and auxiliary apparatus secures a maximum output from a given weight of material, and a high ratio of continuous output to the one-hour motor rating common in railway practice. It also provides effective ventilation while the locomotive is not in operation as the blower may be driven while the locomotive is standing at the station or at the end of the line. Motors ventilated in this manner are enclosed and are thereby protected from internal damage by dirt and water and from mechanical injury.

Each motor is wound for 240 volts and 25 cycles per second and has a nominal rating of 250 hp on the basis of usual electric railway practice.

The essential elements of the control equipment include the collecting devices, the auto-transformers, the unit switches, the preventive coils, the reverser and master controllers. A multi-unit system of control is provided with pneumatically-operated switches, and circuit-breakers, and a low-voltage control circuit. Any unit may be controlled from either end, and two or more units may be coupled together and operated from a single cab and by a single crew. A control circuit is carried from one unit to the next by means of connecting sockets and jumpers in the usual manner.

Speed control of the driving motors is secured by variation of the voltage at the motors obtained by means of taps taken from the winding of the auto-transformer which receives current from the trolley at 3,000 volts and reduces it to 240 volts or lower, according to the tap employed. These taps are connected to unit switches from which current is led through the preventive coils to the motors. Four unit switches serve to reverse the field coils of each motor.

The unit switches are in effect pneumatically-operated circuit breakers of great power and reliability. The mechanism is such that a rolling and sliding contact is obtained when the switch

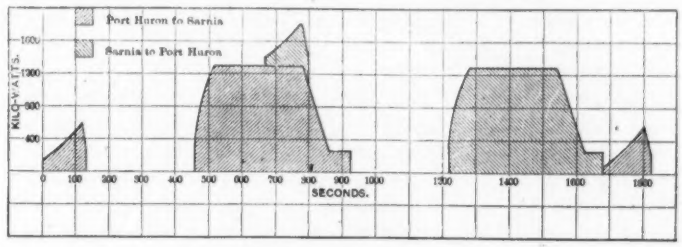
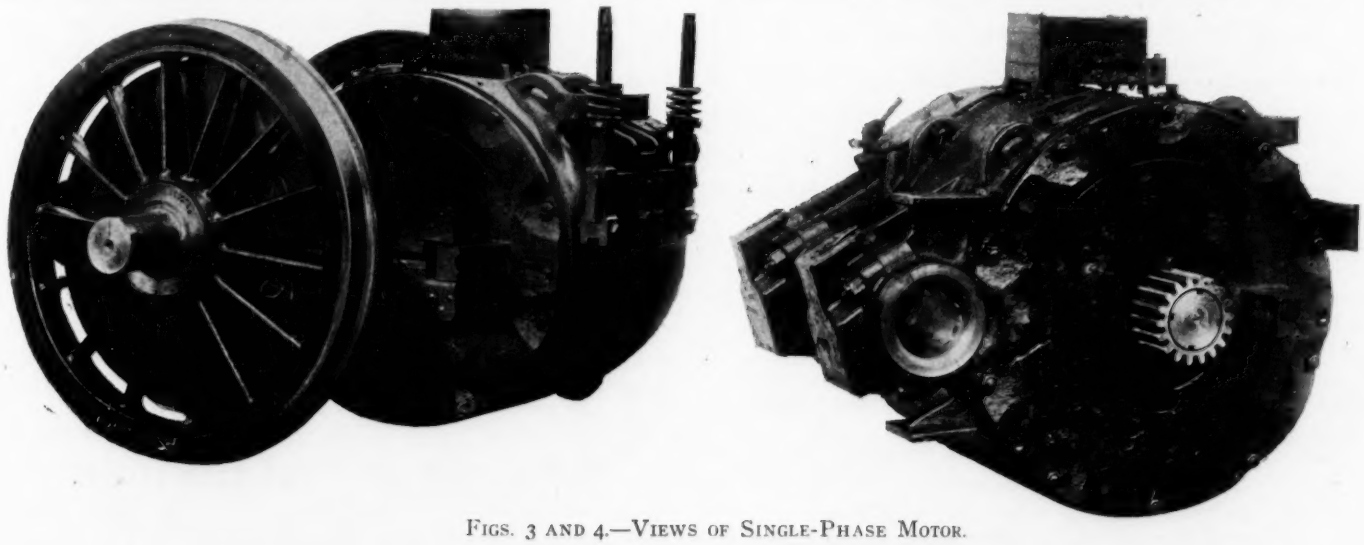


FIG. 5.—CURVE SHOWING POWER REQUIRED TO DRAW 1000-TON TRAINS THROUGH TUNNEL.

closes and opens. The arc is broken at the taps, leaving the contact surfaces smooth and unscarred. Each unit has a magnetic blow-out coil with laminated core. The switch cylinders are controlled by magnetically-operated valves, current for which is obtained from a 50-volt tap from the auto-transformer. The sequence of operation is governed by the master controller in conjunction with a system of interlocks which prevents short-circuit of the steps between taps from the auto-transformer or improper operation of the controlling mechanism. At any running point four controlling switches are closed. Through the preventive coils approximately the same amount of current is drawn from each of these switches and the leads to which they are connected. To change to a higher voltage on the motors, the master controller is moved to the next notch, opening the last switch of the group that is closed and closing the switch next higher, with the result that the motor voltage is shifted up one step. By this arrangement the voltage at the motor will be completely under control of the locomotive driver and may be varied up and down at will without interrupting more than one-quarter of the load current. Small switches in the circuits to the magnets of the reversing switches will enable any motor or combination of motors to be cut out without disturbing the others.

Every one of the 17 controlling connections provides an efficient



FIGS. 3 AND 4.—VIEWS OF SINGLE-PHASE MOTOR.

running point. This number is ample to prevent any slipping of the driving wheels due to increase of current from one notch to another. Whether empty or heavily loaded, operated in single or multiple units, torque and draw-bar pull may be gradually applied and the locomotive started without jar.

Each locomotive unit will be equipped with a pneumatically-operated pantagraph trolley to collect current from the overhead lines outside the tunnel and throughout the yards. The proportions of the pantagraph will be such that, when extended, it will make contact with the trolley wire 22 ft. above the rail, and, when closed down, the contact shoe will not extend more than 18 in. above the roof of the locomotive. The pantagraph will have a broad base and will be constructed of light and stiff material. A No. 4-0 grooved overhead trolley wire will be suspended from a single 5/8-in., high-strength, double galvanized, steel strand, messenger cable by hangers of varying length in such a manner that the trolley wire will be approximately horizontal. The messenger cable will be swung from structural iron bridges of suitable length to span the proper number of tracks. There will also be a small section of track equipped with a trolley line swung by catenary suspension from bracket arms which are supported on lattice-work poles.

For the operation of the electric locomotives a complete power plant will be installed by the St. Clair Tunnel Company, including two 1,250-kw, 3,300 volts, three-phase, 25-cycle, 1,500 r.p.m., rotating-field, Westinghouse steam turbine units with the necessary complement of switchboards, exciters, lightning protective apparatus, etc. This station will also supply power to light the buildings, yards and tunnel, to operate motor-driven centrifugal and triplex pumps which drain the tunnel and approaches and operate the sewage system, to run motors in the roundhouses and for other purposes.

The pump motors will be of the three-phase induction type, wound for 440 volts. In each of the roundhouses, one at Port Huron and one at Sarnia, there will be installed a 50-ton, three-phase motor to be operated directly at the transmission e.m.f. of 3,300 volts. There will be two 40-kw, 125-volt, direct-current exciter generators, one of which will be driven by a steam turbine, the other being direct connected to a 3,300-volt, threee-phase induction motor. The switchboard will provide for one single-phase railway feeder, four three-phase pumping feeders, and four three-phase lighting feeders. A Tirrell regulator used in connection with the exciters will serve for maintaining the voltage at the proper value.

The new equipment will handle that portion of the Grand Trunk Railway system which connects the divisions terminating at Port Huron, Mich., and Sarnia, Ont., on opposite sides of the St. Clair River. The tunnel proper is 6,032 ft. long, and the line to be electrically operated measures 19,348 ft. from terminal to terminal.

A pair of the new units will be capable of hauling a thousand-ton train through the tunnel without division. Mechanical considerations limit the advisable weight of train in the tunnel to these figures. Heavier trains can be divided or sent through together with locomotives in front and behind. The service requires that each unit shall take a train of 500 tons through the tunnel block from summit to summit in 15 minutes, under the following conditions:

It will be coupled to the train on a level track at a point 1,200 ft. from the summit and must accelerate it up to a speed of 12 miles per hour in two minutes, at the end of which time it will have reached the summit of the grade leading down into the tunnel. It will then run down a grade of 2 per cent to the level track in the tunnel at a speed not exceeding 25 miles per hour, continue on the practically level stretch under the river, and then draw the train up a 2 per cent grade at the rate of 10 miles per hour to the level track beyond the tunnel approach on the other side. It must then gradually accelerate the train until a speed of 18 miles per hour is reached. Each unit must be capable of exerting a tractive effort of 25,000 pounds for a period of 5 minutes, in addition to the force, required to accelerate the train at the starting point and to run with it into the terminal yard, from which point it must immediately run back to a position 1,200 ft. from the summit, couple to another train and be ready to start through the tunnel in the opposite direction. It must, therefore, make a run of the character described every 30 minutes.

It is expected that the electric equipment will greatly relieve the present traffic congestion, which is due in a large measure to the necessity of dividing trains at the terminal points, and will greatly simplify the operation of the road.

The work of installation will be conducted under the supervision of Mr. Bion J. Arnold, of Chicago, consulting engineer for the tunnel company, by whom the plans and specifications were prepared.

New Telephone Patents.

SYSTEM OF TELEPHONY.

A system of telephony has been patented by Mr. A. G. Davis, of Schenectady, N. Y., in which the telephone current or wave is related to the resonance of the transmitting circuit. With such a system we must, of course, have a primary source of alternating current which produces a current of frequency and wave form such that it is inaudible in the receiving mechanism. If a line be charged with such a current and then by the proper design of the telephone instruments with regard to capacity and inductance, a combination circuit may be formed which will resonate perfectly, or in as near perfect resonance as desired with the impressed alternating current. Mr. Davis advocates a circuit slightly out of tune, where a slight effect upon the constants of the circuit varies the current rapidly. For a transmitter for varying the constants he suggested the familiar condenser transmitter and also a transmitter similar to the magneto transmitter except that it is not polarized. One will affect the capacity, the other the inductance. Mr. Davis conceives a relation between his transmitter and resultant current such that the instantaneous current values will approach proportionality with the instantaneous positions of the diaphragm with reference to its normal position.

A multiplex system is also suggested by varying the frequency of the impressed alternating currents and providing several simultaneous sources of supply.

COMBINED TELEPHONE AND TELEGRAPH SYSTEM.

A combined telephone and telegraph system has been brought out by I. Kitsee, of Philadelphia, for use along railways. Normally the telephone and telegraph are both connected to the line. The former is of no effect on the latter because of condensers included in its circuit. Similarly, the telegraph is of no effect upon the telephone because, first, of its inductance and second because the batteries of all stations are similarly poled and substantially equal. In order to telegraph the sending station must reverse its battery. This is the key to the invention.

PARTY-LINE SYSTEM.

R. H. Polk has invented a party-line ringing device which consists of special switchboard circuits adapted by the use of two jacks for each two-party line to ring each station the same as for direct use. The bells of the stations, one off each side of the line, are grounded through condensers. If we ring on one jack we ring one side of the line. If we ring on the other jack, a reversing relay reverses the line automatically.

Letters to the Editors.

Switch Mechanism.

To the Editors of Electrical World:

Sirs:—Your editorial of December 23, 1905, on "Converter Sub-Stations" makes some pointed remarks about the present craze in the design of switchboards in which everything possible is made automatic. The tendency to revert to simpler apparatus is apparent, but the cost of some of the switchboards and switch control mechanisms in some modern stations is appalling and amounts, in a great many cases, to absolute waste. As I have said before the International Electrical Congress, it is better to burn up occasionally an inexpensive switch than to burn up all your money in the beginning by expensive switches and mechanisms.

The switchboard should be so simple in design and operation that a glance at its face, the machines and lines will indicate the use of every piece of apparatus on it. I have been criticised by some engineers for the "extreme" to which I have gone to eliminate all possible automatic apparatus, but a record of the operation of our stations sustains my course. We have very little automatic apparatus, yet most of our trouble has been with this class of apparatus. The hand-operated or "brain-operated" apparatus has practically a clean record.

I would also plead with the manufacturers to make switches of two classes, one class being operated electrically or by oil or air under pressure, and the other arranged for the simplest mechanical operation. Many stations do not need, and some cannot afford, the more expensive apparatus, which is generally good to show—if the cost is not mentioned. Every switch manufactured ten years ago is probably obsolete to-day, which should be remembered when laying out new work. As an example, during the last two years it became necessary to replace every high voltage switch on the system of the California Gas & Electric Corporation. To have installed the apparatus offered by manufacturers would have cost about $200,000. Hand-operated switches of our own make were installed instead at less than one-fifth the cost, and these have stood every test that has been put on them. Where possible, all switches are operated by a simple lever, and we have found that a man on one end of a lever is the surest way of producing a desired result on the other end.

SAN FRANCISCO, CAL. F. G. BAUM.

Topical Classification for Electrical Engineering References.

To the Editors of ELECTRICAL WORLD:

SIRS:—I have noted with interest the recent article by Mr. George Parsons on "A Topical Classification for Electrical Engineering References," pages 910-912, of Vol. XLVI of your journal.

I thoroughly approve of his statements concerning a topical classification with energy as the fundamental basis of the arrangement; the possibilities for expansion, and the writing and classification of notes on cards. Mr. Parsons' illustration with respect to the Cooper Hewitt mercury vapor lamp to show the advantage of the topical over the alphabetical classification is apt. I may be permitted further to remind you that the topical classification is independent of language and can be employed for international service where no alphabetical classification could serve. The classification of articles on "nitrogen" with its German and French equivalents, "Stickstoff" and "azote," will illustrate what I mean.

I desire, however, to call Mr. Parsons' attention to the fact that the International Institute of Bibliography of Brussels has published in French a very considerable development of Melvil Dewey's last classification, which is at least worthy of mention.

Mr. Parsons could have distinguished more thoroughly between the *manufacture* and *use* of electrical machinery, although the basis of the classification is "energy." The electrochemical engineer manufacturing accumulators will not be satisfied with the complete separation of this subject from "primary cells"; "accumulators" and "primary cells" should have a general head in common. Many patents, for instance, are taken out on jars, grids, insulators, etc., covering their use in both primary and secondary cells. If no general head is provided such references must be duplicated.

It would further seem Mr. Parsons' intention to place notes on fuses, circuit-breakers, etc., in at least three places. This would again not satisfy the manufacturer of these articles, unless it is intended to group duplications of such reference under the sub-heads, "Interior wiring."

The subdivision "Chemistry and direct products," if signifying electrochemistry, it would be impossible to develop and retain consistently under electrical engineering. If the classification is to follow Dewey—and uniformity cannot be over-emphasized—this subject belongs properly to "chemical technology" and to "metallurgy."

I would further recommend the use of symbols—and decimal symbols, as suggested by Dewey, have been found the simplest—for the subjects; especially if the notes are numerous and are to be frequently worked with, and if time is a factor.

These decimal symbols also tend to equalize chapters of like importance and will remove such distortion as is to be noted in Mr. Parsons' classification where "electrolytic rectifiers" (a second-place sub-head under "transformation," appears to be of as much importance as the second-place sub-head under "utilization," "electric railways."

CONCILIUM BIBLIOGRAPHICUM, ZURICH. A. L. VOGE.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Single-Phase Motor.—AMMON.—In a report of the Olympia electric exhibition in London, a 10-hp Goldschmidt motor, built by Crompton & Co. for 750 r.p.m., with four subdivided slip rings, is described. The rotor has a three-phase star winding. On each of the slip rings a number of insulated rods is placed corresponding to the number of poles. These insulated rods are all connected with the neutral point of the rotor winding. The arrangement is shown in Fig. 1 and the action is as follows: If a brush is in such a position that it connects the slip ring with one of the insulated rods, one of the rotor phases is short-circuited and gives a repulsion torque. The corresponding position of the brushes on the different slip rings yields a continuous torque. The brushes on the slip rings are connected with a starting resistance which is gradually short-circuited. The motor then continues to run as an induction motor. The motor control is accomplished by a small displacement of the brush yoke and for this purpose the latter is connected mechanically with the regulator. The motor gives a starting torque equal to 1.75 times the full-load torque while consuming 1.5 times the current. The controller which is used with this motor for elevators is provided with a brake-cylinder to prevent too rapid switching-in, while on the other hand an immediate switching-off is accomplished by springs. —*Elek. Zeit.*, December 28.

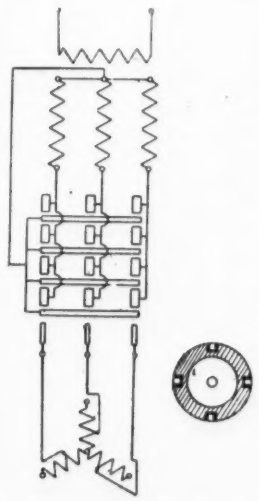


FIG. 1.—SINGLE-PHASE MOTOR.

Compensated Single-Phase Motor.—LEHMANN.—In studying the compensation of single-phase motors the author has been led to a class of compensated motors, the feature of which is that the compensation of the phase difference is obtained without auxiliary brushes so that the number of necessary brushes becomes equal to the number of poles. The author proposes to discuss in his article the theory of these motors and to compare the theoretical conclusions with the results obtained in practice. The arrangement discussed by him is shown in Fig. 2. It shows an ordinary repulsion motor with a commutator and short-circuited brushes, the line between the brushes being displaced against the direction of the primary field. The stator may have an ordinary continuous winding, supplied with current at two points, *a b*, but being also connected at two other points, *c d*, with n adjustable reactance, *L*. The author shows that by properly adjusting the value

of L and the angle between the lines, c d, and the direction of the primary field, it is possible to obtain perfect compensation of the phase difference at different loads. At the same time it is possible to adjust the torque by this method. Further, if the magnetic reluctance is the same in all directions, a perfect revolving field is obtained at synchronism and consequently the voltage between the segments of the commutator disappears at this speed. In the present installment the author gives the mathematical theory.—*L'Eclairage Elec.*, December 23.

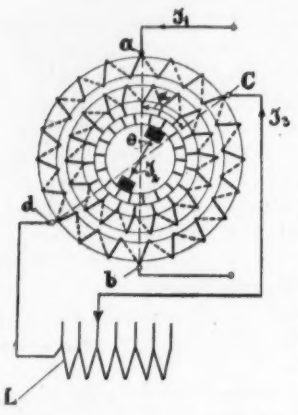


FIG. 2.—COMPENSATED MOTOR.

Commutation Poles.—ARNOLD.—A note supplementary to his recent theoretical article on commutation of direct-current machines and interpole construction. He gives a numerical example from practice. In this case the reactance e.m.f. calculated according to Hobart is 0.92 volt and calculated according to Mueller is 0.75 volt; since a reactance e.m.f. below 2 volts is considered the criterion for good commutation it would follow that the machine should behave well as to commutation. As a matter of fact, however, it tends to spark. This shows that the reactance voltage alone does not determine the liability to spark.—*Zeit. f. Elek.* (Vienna), December 24.

Liege Exposition.—REYVAL.—An illustrated description of a gas-driven generating set exhibited at Liege. The 250-hp gas-engine is exhibited by the Deutz Company, the generator by the Garbe-Lahmeyer Co. The speed is 160 revolutions and the 143-kw generator gives 1,240 amperes at 115 volts. Details of dimensions are given.—*L'Eclairage Elec.*, December 23.

Lights and Lighting.

Conductivity of the Vapor from the Mercury Arc.—CHILD.—An abstract of a paper presented before the Am. Phys. Soc. on an investigation of the space in the neighborhood of a mercury arc. The vapor coming from a mercury arc is highly conducting. A luminous space gradually spreads out from the arc, and the front of this region has the greatest conductivity and the greatest luminosity. This conductivity is not due directly to ions coming from the arc, nor to rays sent out by it. It is not due to any leakage over the surface of the glass. It is probably not due to the high temperature of the gas. A probable explanation is suggested by Prof. Ernest Merritt, that is, that when the ions first recombine, they are in a condition of unstable equilibrium, much like the atoms of radio-active matter and that many of these combinations break up again into positive and negative ions. There is an e.m.f. between electrodes inserted in different parts of the tube, which is possibly due to the more rapid diffusion of the negative ions.—*Phys. Rev.*, December.

Power.

Power in Cement Plant.—An illustrated article on the electric power plant of the Lakefield Portland Cement Co. Electric power is transmitted from two hydraulic stations. There are connected to the various machinery throughout the works four 100-hp, five 50-hp and one 15-hp and two 10-hp induction motors.—*Canadian Elec. News*, December.

Electricity in Mines.—GUARINI.—An illustrated description of some electrical installations in European mines, describing different kinds of apparatus for chain and locomotive haulage, hoisting and ventilating.—*Mines and Minerals*, January.

Electric Winding.—CREPLET.—A paper presented before the Liege Congress on the electric driving of winding drums for pitmouth haulage, with special reference to the practice at a French mine.—Lond. *Elec. Rev.*, December 15.

Fan Blowers.—SNOW.—An illustrated article of a general nature on the condition of fan-blower design.—*Cassier's Mag.*, January.

Electric Capstans.—DAVY AND RAUDOT.—An article on electric capstans, which are divided into three classes: First, those with direct-connected motors, second with spur gearing, and third with worm gearing. The authors are in general favor of the second class. Some results with an electric capstan of a French make are given.—*L'Industrie Elec.*, December 25.

Lathes.—PERKINS.—A fully illustrated article on large electrically-driven lathes.—*Iron Age*, January 4.

Efficiency of Steam Turbines.—MARGUERRE AND ANDERS.—Two communications in which the authors continue their controversy on the method of determining the efficiency of steam turbines. *Elek. Zeit.*, December 28.

Boiler Water.—SNOW.—An illustrated paper on water softening for boiler use.—*Jour. Western Soc. Engs.*, December.

Cost of Power.—GRIFFIN.—An article giving formulas and a diagram for calculating the cost of generating electric power for varying cost of coal and for varying average output of the machines expressed as fraction of their rated capacity.—*St. R'y Jour.*, December 30.

Traction.

Hanger Bolts.—TWEEDY.—An article on preventing the failure of insulated hanger bolts on electric tramways. The failure is due to the deposition of conducting and foreign matter and to the formation of oxides, and these again are caused by moisture which is thrown into the hanger as the trolley wheel passes under it. The author, therefore, interposes a shield between the trolley wheels and the bolt. He does this by stamping out an annular disc from hard or flexible fibre, rubber, dermatine, or even a metal sheet, which is threaded over the end of the hanger bolt, and retained in position by clamping it between the top of the lug of the ear and the underside of the hanger bolt. Some results are given from actual practice.—Lond. *Elec. Rev.*, December 29.

Electric Automobiles.—JOEL.—The author criticises the article of Rae, published in Elec. World and Eng. October 21, 1905. In calculating the power required to start and run a truck of 9 tons, Rae assumes a draw-bar pull of 30 lbs. per ton, and he calculates that two electric motors giving together 4.8 hp would be sufficient to run this truck. The writer claims that this is far too low and that the "whole article, with calculations, curves and results, is unfortunately based upon these false premises and is therefore erroneous."—Lond. *Elec. Rev.*, December 29.

Improvements in Trucks.—COOK.—An abstract of a paper read before the (Brit.) Tramways and Light Railways Association. The author discusses various improvements in the construction of trucks. The author considers the radial truck as one of the most important improvements, since it combines the best qualities of the single-truck car and the double-truck car.—Lond. *Elec.*, December 22.

Installations, Systems and Appliances.

Supervision of Electric Installations; Accident Statistics.—PASSAVANT.—A paper read before the Berlin Elec. Soc. Prussia, intends to introduce supervision of all electrical installations by the government. The author as a representative of the electrical industry is strongly opposed to this. Five years ago the act of regulations and rules for electric installations, prepared and adopted by the German Assoc. of Elec. Engs., was not strictly followed by all firms, and the association could not enforce the rules. At that time some of the electrical engineers being annoyed by the opposition called for supervision by the government. This is now considered to have been a great mistake, and it is thought that such supervision when becoming a law will hurt the developments of electrical industries in Germany. There is thought to be no justification for official supervision

ACCIDENTS IN MINES.

Year.	Total number of fatal accidents.	Due to electricity. Fatal.	Due to electricity. Not fatal.	Due to explosions. Fatal.	Due to breaking in of tunnels, etc. Fatal.
1899	859	4	1	26	394
1900	848	2	5	20	403
1901	956	2	0	59	431
1902	818	4	5	10	391

of electrical plants. In 1904 there were in Germany between 200,000 and 250,000 accidents, of which 1,000 were fatal, but among these 1,000 there were only 16 electrical accidents and half of them occurred in high-tension installations and were due to great carelessness. The preceding statistics on fatal accidents in mines are given for four years.

There were one hundred times as many fatal accidents due to the breaking-in of tunnels, etc., as to electricity. During the first 11 months of 1905 there were 7 fatal accidents in Germany due to escaping gas, and 48 accidents due to gas explosions, but nobody has yet thought of supervision of every gas installation by the government. The claim that there are dangers of fire from electricity is thought to be very much exaggerated. From the statistics of a large German fire insurance company it appears that during the seven years from 1894 to 1900 there were 42,369 fires, of which only 169, that is, about 0.4 per cent, were due to electricity. It is significant that the number of electric fires in the four years from 1901 to 1904 has remained almost the same, although the number of electric installations has very much increased. The author concludes that this shows that the rules and regulations of the association are now finding general recognition in practice, although they are not enforced by the government, and that general government control would be a nuisance. He agrees that special buildings, such as theatres, store-houses, etc., should be subjected to government control, but on account of their special character and not on account of the electricity used in them.—*Elek. Zeit.*, December 28.

Berlin Electricity Works.—A statistical article on the development of the Berlin Electricity Works. Fig. 3 shows the development from 1894 to 1905. All the figures represent kw-hours consumed. The drawn-out curve gives the consumption of electric energy for motors (37,219 kw-hours in 1904-5); the light dotted line the consumption for traction purposes (47,288 kw-hours in 1904-5); the highest curve gives the total consumption. On June 30, 1905, 12,549 electric motors with an aggregate capacity of 39,921 hp were connected to the mains. They were used for the following purposes: Ventilators, 1,868 motors (601 hp); presses, 1,730 (5,005 hp); metal-worker shops, 1,775 (7,551 hp); elevators, 1,698 (9,704 hp); wood-worker shops, 1,241 (4751 hp); butchers, 678 (3,394 hp); grinding and polishing machines, 376 (1,390 hp); paper cutters, 369 (1,149 hp); pumps, 252 (906 hp); sewing machines, 229 (201 hp); cloth cutters, 194 (140 hp); laundries, 230 (672 hp); spooling machines, 96 (274 hp); leather-worker shops, 111 (417 hp); electroplating shops, 75 (239 hp); for driving dynamos, 76 (809 hp); for grinding and roasting coffee, 78 (153 hp); for cleaning hats, 27 (74 hp); for miscellaneous purposes, 1,446 (3,491 hp). For the year 1904-5 there was an increase of 1,937 electric motors having a total capacity of 6,132 hp. At the end of June, 1905, the total length of the cable network of the Berlin Electricity Works was 3,736 kilometers.—*Zeit. f. Elek.* (Vienna), December 24.

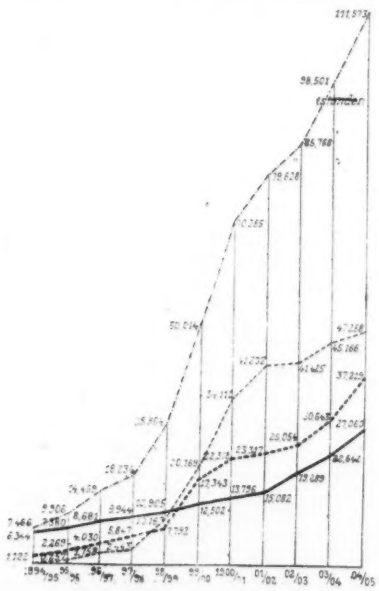


FIG. 3.—CHART SHOWING ELECTRICAL DEVELOPMENT.

Power in Tall Office Buildings.—BENJAMIN.—An article giving the results of some tests of the power plants of three tall office buildings in Cleveland, A and B being 14-story high buildings, relatively narrow and deep, while C is only 10 stories in height, but covers a large area. A and B employ hydraulic elevators while in C electricity is used both for lighting and for elevator service. The cost of boiler hp per day was 17.8 cents in A, 14.5 cents in B, and 18.5 cents in C. These figures do not include rent, interest, or depreciation. The high cost of power compared with that in a power plant is due to the boilers being run so much below their capacity. The total cost of power per square foot of space per year works out as 16.3 cents in A, 10.6 cents in B, and 6.26 cents in C. These figures seem very low, compared with figures of Wilson from tests of New York sky-scrapers, who found the corresponding cost for buildings of 15 and 18 and 16 stories as 35 cents, 15 cents and 14 cents, respectively. "The extremely low cost shown by building C would seem to indicate better economy in power for a moderately high building covering a large area than for the tower-type of building. The use of electric elevators in place of hydraulic elevators points to a saving in power. The cost of electric power in this building was about 2 cents per kilowatt-hour."—*Cassier's Mag.*, January.

Lead Poisoning Due to the Electrolysis of a Water Pipe.—LATHAM.—An abstract of a paper read before the Brit. Asso. of Water Works Engs. The author refers to a case of lead poisoning which was clearly traced to the electrolytic effect of a leakage current on a water pipe. The paper emphasizes the importance of earthing in an effective manner, at the generating station, the negative pole of an uninsulated return system of private house wiring. If this precaution is taken and the installation is otherwise carried out in a satisfactory manner, there is no likelihood of any electrolysis occurring.—Lond. *Elec.*, December 22.—In the same issue a letter by Nalder records a case in which an electric lighting company's own cable was damaged by electrolysis. This matter is commented on editorially.—Lond. *Elec.*, December 22.

Surging in High-Tension Lines.—DAVID.—An account of oscillographic researches made by the Central Electrical Laboratory of Paris on the high-tension circuit of the Mediterranean Coast Power Co. Instantaneous values of e.m.f. and current were obtained by means of a Blondel-Charpentier oscillograph. Various oscillographs are reproduced.—*Elec. Rev.*, January 6.

Electricity on Board Ship.—KERGAROUET.—A continuation of his article on applications of electricity on war ships. The author considers the adoption of a voltage of 120 as an important progress. He deals with the methods of wiring and distribution.—*L'Eclairage Elec.*, December 16.

Chicago Station.—A fully illustrated description of the Fisk Street Station of the Commonwealth Electric Co., of Chicago. It is equipped entirely with steam turbines, and the most modern apparatus, and will have a capacity of 156,000 kw.—*Western Elec.*, January 6.

Electrophysics and Magnetism.

Very Thin Films.—KOENIGSBERGER AND MUELLER.—A description of a method by which the authors are able to observe optically an oxide film on a metal of molecular thickness. One conclusion drawn is that the passivity of iron cannot be due to an oxide film.—*Phys. Zeit.*, December 1.

Measuring the Speed of Roentgen Rays.—MARX.—The principle of his method is the same as mentioned recently in the Digest. The author has now modified the method so as to be applicable for demonstration purposes in the lecture room.—*Phys. Zeit.*, December 1.

Electronic Theory.—BUCHERER.—A note in which the author expresses doubts as to the validity of Lorentz's hypothesis of deformed electrons and offers, himself, a modified hypothesis of an incompressible deformed electron which is believed to avoid some difficulties.—*Phys. Zeit.*, December 1.

Discharges Through Gases.—WILHELMY.—An historical sum-

mary of researches on the discharge of electricity in gases, up to the foundation of the electronic theory.—*Dissertation of Cathlic Univ. of America,* Washington, 1905.

Electrochemistry and Batteries.

Storage Batteries.—Parr.—A paper read before the Leeds Section of the (Brit.) Inst. of Elec. Engs., on storage batteries, their deterioration and the cost. The author discusses the usual impurities in sulphuric acid and water. Pure distilled water should always be used since its cost is trifling in comparison with the cost of a new battery which the use of impure water might entail. The practice which some central station engineers adopt of using the condensed steam from the boilers is dangerous, because boiler water, in addition to its natural impurities, often contains some special alkaline softening fluid. Another equally dangerous custom with some engineers is to add from 1 oz. to 2 oz. of ammonium sulphate, sodium sulphate or sodium carbonate per gallon of the electrolyte, with the object of improving the condition of the cells. This practice, while giving a rich color to the plates, in time acts detrimentally on them, diminishing both the capacity and the efficiency. Accepting the limitations put by battery makers on the amount of impurities allowable, it would seem that the electrolyte should be free from arsenic, nitrogen compounds, sulphuretted hydrogen, sulphurous acid, and organic matter, and that it should contain only mere traces of hydrochloric acid and iron. The author is making a long series of tests on the effect of different impurities in the electrolyte on the behavior of the battery. In the results so far obtained sulphurous acid appeared to have a deteriorating effect, although the tests are not yet closed. Some results are given of tests of a lead battery with different rates of charge and discharge. One of the diagrams given by the author shows clearly that the higher the discharge rate, the shorter is the time required for recharging and the smaller the output. Fig. 4 shows the results of tests made to determine

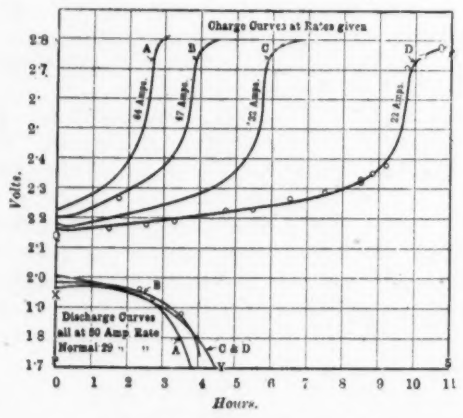


FIG. 4.—STORAGE BATTERY CURVES.

the effect of different rates of charge upon the discharge capacity at a certain constant rate. The curves show that within the current limits taken the rate of charge has but little or no effect on the output of the cell at the particular rate of discharge. —Lond. *Elec.,* December 29.

Injurious Effect of Acid Pickles on Steel.—Burgess. A phenomenon attendant upon the pickling of iron and steel articles by the use of acid solutions is the influence which such treatment exerts upon the physical properties of the metal. The injurious effect is often shown by the ruin of steel springs and other tempered articles which accidentally or by design have been subjected to the action of acid solutions. The author has studied the cause of this phenomenon and shows that the brittleness or "rotting" of iron and steel is due to the penetration into its pores of hydrogen rather than of acid, so that any method which would prevent the liberation of hydrogen would do away with the usually consequent brittleness. If nitric acid of such strength that no hydrogen is evolved be used, a bent steel wire may be completely dissolved without breaking, while when other acids are employed the wire snaps in two before corrosion has proceeded to any appreciable degree. If sodium nitrate be added to a sulphuric acid solution the liberation of hydrogen can be prevented and it may thus serve a most useful purpose. To avoid all necessity of pickling tempered steel springs, preparatory to plating, it may be possible that the tempering could be done in such a way as to prevent the formation of the oxide scale. With the idea of bringing about such a result an experiment was undertaken by covering the melted lead tempering bath with a layer of borax. Upon immersing a steel spring into the lead, through the layer of borax, the oxide was dissolved, and after subsequent immersion in oil and water a bright surface ready for electroplating was obtained. In some such way the disadvantages attendant upon the usual pickling process might be avoided. The harmful effect which hydrogen exerts is an additional argument for the substitution of the sand blast for the ordinary pickling method, but its universal adoption can hardly be looked for on account of the greater expense that would be entailed, especially in the handling of small work.—*Electrochem. and Met. Ind.,* January.

Ozone.—Steens.—A communication on the Marmier-Abraham system of producing ozone from air by electric discharges, and the sterilization of water by ozone.—*Eng'ing Record,* January 6.

Electrometallurgy of Zinc.—Peters.—A concise summary of developments and proposals made during the last years on the use of electrolytic or electric furnace processes in the electrometallurgy of zinc.—*Glueckauf,* December 2, 9, 16.

Units, Measurements and Instruments.

Losses in Induction Motors.—Bache-Wig and Bragstad.—To separate the losses in three-phase induction motors the following method may be used. The induction motor to be tested is driven by a direct-current shunt motor with which it is either connected directly or by a belt. The watt consumption of the auxiliary motor is first determined while driving the non-excited induction motor with open rotor; this is done at different speeds above and below synchronism. By these measurements the power consumed by the auxiliary motor + the power consumed by the belt + the friction of the induction motor are measured. In the case of direct connection of the two motors there is no consumption of watts by the belt. Secondly, at several speeds above and below synchronism measurements are made of the power consumption of the auxiliary motor when driving the induction motor with open secondary, but with excited primary. At the same time the watt consumption of the primary is measured at these speeds. The curves obtained in these measurements show a characteristic discontinuity at synchronism as well as in the watt curves of the auxiliary motor as in those of the stator. This discontinuity is due to the hysteresis torque. The watt consumption of the auxiliary motor is the sum of the loss of the auxiliary motor and of the belt; further of the friction and of the additional losses of the non-synchronous motor; and finally, of an amount of power corresponding to the hysteresis torque of the rotor of the induction motor. This last amount of power is negative below synchronism and is positive above synchronism. The difference in the measurement of watts of the auxiliary motor in the second and in the first tests therefore give below synchronism the additional losses minus rotor hysteresis and above synchronism the additional losses plus rotor hysteresis. The additional losses are therefore equal to the average of the two differences above and below synchronism. If the power consumed by the auxiliary motor is plotted as a function of the speed, first with the induction motor without current ("curve 1") and secondly with excited primary, but opens secondary of the induction motor ("curve 2"), then the sudden rise of the curve 2 at synchronism represents twice the rotor hysteresis, while the average height of the curve 2 above curve 1 represents the additional losses. The power supplied to the primary by the three-phase currents gives the iron losses. In order to determine the friction of the induction motor, its no-load losses are measured by running it unloaded with closed secondary and disconnected auxiliary motor. The power consumption thus determined less the iron losses and additional losses determined before gives the friction. Several numerical

results of actual tests are given.—*Zeit. f. Elek.* (Vienna), December 3.

Electrolytic Meters.—HOLDEN.—An illustrated paper read before the Birmingham section of the (Brit.) Inst. Elec. Engs. The author describes two new electrolytic meters. In the first one, the whole current passes through the meter, and the meter is essentially a simple gas voltameter, the weight of liquid which is decomposed being the indication of the ampere-hours. The second meter is a shunted one and employs so-called hydrogen electrodes, which have so far been used only in scientific research. A hydrogen electrode is a platinized platinum electrode saturated with hydrogen. Any hydrogen being evolved on it as cathode is absorbed by the platinum black. On the other hand, if such an electrode is used as anode and dips only partly into the solution while the remainder is in an atmosphere of hydrogen, then no oxygen is set free at this electrode, but hydrogen passes from the electrode into the electrolyte, forming water. A combination of two such electrodes as anode and cathode, therefore, shows no polarization so that when by a shunt arrangement only a part of the total current passes through such a combination, the current passing through the cell is always exactly proportional to the difference of potential at the terminal electrodes.—Lond. *Elec.*, December 22.

Meters.—GERHARDI.—A continuation of his long illustrated serial on electricity meters. In the present installment the author describes and gives diagrams of the connections of three-wire circuit meters and polyphase meters.—Lond. *Elec.*, December 22.

Vacuum Pump.—FISCHER.—An illustrated description of a new rotary oil pump of the Siemens-Schuckert Co., by which it is possible to produce conveniently an extremely high vacuum. —*Phys. Zeit.*, December 1, and *Dingler's Polyt. Jour.*, December 2.

Selenium.—WULF AND LUCAS.—An account of measurements made with selenium cells during the total eclipse of the sun August 30, 1905. The selenium cell may be used for two purposes, first for determining the change of light and second for determining the time moment of the beginning and the end of the total eclipse.—*Phys. Zeit.*, December 1.

Standards of Resistance.—GIROUSE.—An account of a verification of the standards of the legal ohm. The results obtained in 1905 agree very well with those of 1885.—*L'Eclairage Elec.*, December 23.

Electric Thermostat.—CHANDLER.—An illustrated description of a small electric thermostat in which mercury expands and closes the circuit at a predetermined temperature.—*Scien. Am. Supplement*, January 6.

Telegraphy, Telephony and Signals.

Telegraphy.—MAVER.—Some notes on telegraphy in Asia. The yearly receipts of the Persian telegraph system are about $7,500, and the expenses of operation and maintenance about equal the income. In Japan there are in operation about 850 telegraph circuits, of which 90 are worked duplex and 10 are worked quadruplex, the remainder being worked on the ordinary simplex Morse sounder system. The simplex circuits are operated on the "open-circuit" plan, and, as a rule, current is supplied by Daniell cells, which, however, are being supplanted now by storage batteries in the larger cities. Japan has now about 20,000 miles of land telegraph lines and about 85,000 miles of wire. The total number of paid telegrams transmitted over these lines annually is about 17,000,000. Messages are transmitted in Japanese letters and in Roman letters.—*Cassier's Mag.*, January.

Influence of Earth in Wireless Telegraphy.—SACHS.—An account of experiments in which the transmitter and receiver were electromagnetically coupled. The author endeavored to examine the influence of the earth on the propagation of waves. His main conclusions are as follows: The earth's surface is for waves of 31 metres, a strong absorbing and weak reflecting medium. The connection to earth of sender or receiver is greatly prejudicial to transmission; insulating it is decidedly favorable. It is desirable to install the apparatus as high above the earth as possible. The integral effect at the receiver varies inversely with the square of the distance of transmission.—From *Ann. der Phys.*, abstracted in Lond. *Elec.*, December 29.

Telephone Tariffs.—The conclusion of a systematic summary and analysis of telephone tariffs in different countries.—*Jour. Telegraphique*, December 25.

Plant of the Trumbull Electric Manufacturing Company.

The Trumbull Electric Manufacturing Company, of Plainville, Conn., has recently completed a modern three-story and basement brick building for the accommodation of its rapidly growing factory equipment. The modest beginning of the company was made in a small one-story wooden structure where rosettes were manufactured. When a little later the company started the manufacture of switches, an engine room was added to the original structure, and then another story, until in 1903 the business assumed such proportions as to necessitate the addition of a two-story and basement ell-shaped extension, the company then undertaking the manufacture of switchboards.

At present the original room in which the company started is used as a storeroom for copper used in switchboard work, and the floor above is used to store finished stock. A large assortment of slate for switchboard use is stored in the basement of the ell-shaped extension, on the first floor of which are machines

SWITCH ASSEMBLY DEPARTMENT.

for cutting and trimming steel parts for cabinet boxes, grinding and buffing machines, and machines for drilling bolt and screw holes in slate. Here is also mounted and assembled all the heavier switchboard work. The upper story is occupied by the cabinet department, where wooden trims for cabinet and switch boxes are made.

The new building is of slow-burning mill construction and is connected with the old building by a covered arcade. The basement is utilized as a receiving room for slate for switch bases, and slate drilling machines are located in one corner of the room. On the floor immediately above is the buffing room, air for which is supplied by two centrifugal blowers in the basement, and standard and special machines for the economical production of the metal parts used in the various devices. Abundant natural light is afforded by day, and at night incandescent lamps spaced every 8 ft. give ample illumination. The dipping and electroplating department is also located on this floor.

A one-story ell houses the power equipment, consisting of a small Atlas engine receiving steam from two horizontal tubular boilers and belted to a main shaft connected to auxiliary and counter shafting from which the various machines are driven. A Crocker-Wheeler generator belt-driven from the engine fly-

wheel through a jack shaft also forms part of the power equipment. The energy from this generator is used to drive a motor which furnishes power to the machines in the switchboard department and also to furnish light. Current for this purpose may also be obtained from New Britain in case of mishap to the generator.

The various processes of assembling are carried out on the second floor, where the lacquering department and a department for the assembly of panel boards are also located. The general offices and drafting room occupy the third floor. An enameling room is located in a separate building. Here the slate is scoured and prepared for whatever finish is desired, after which it passes to steam-heated ovens in the assembly room.

The company is now manufacturing switchboards of any capacity. In addition there is turned out a very complete line of iron service boxes, special cabinet switches and standard switches from 15 amperes to 2,000 amperes capacity in all styles; porcelain base switches and battery switches, fuse blocks, fuse holders, pendant push-button switches, flush receptacles, fused and fuseless rosettes, plug cut-outs, enclosed fuse cut-outs, combination switches, panel cut-outs and panel boards. The officers of the company are F. T. Wheeler, president; J. H. Trumbull, treasurer, and Mr. Henry Trumbull, secretary. A New York office is established at 136 Liberty Street, in charge of T. D. Watson, where a complete stock is carried for immediate distribution.

Some Exhibits at the New York Automobile Shows.

While the magnificent automobile shows held at Madison Square Garden and at the new Sixty-ninth Regiment Armory from January 13 to 20, inclusive, were monopolized almost entirely by gasoline automobiles and their accessories, there were many interesting exhibits of minor electrical devices, and complete lines of electric automobiles. Considering that there were nearly 500 exhibitors on the official lists, it is evident that only a cursory examination could be made of the whole. Some concerns had exhibits at both shows, while others concentrated their energies in one display.

American Electric Novelty & Manufacturing Company, New York City, exhibited its "Ever-ready" automatic starter dry batteries, "bulldog" battery connector, portable electric lights, ammeter and gasoline tank filler. The exhibit was in charge of Messrs. E. J. Alvin, O. J. Bryan, G. W. Edge, F. A. Boss, S. S. Shepard, L. Keller, J. F. Eline and C. K. Crossman.

Atwater Kent Manufacturing Company, Philadelphia, Pa., displayed its line of voltmeters, volt-ammeters, timers for one, two, three and four cylinders, switch with and without plug attachment, spark generator and mechanical device using one non-vibrating coil. Messrs. Kent, Raymond, Dunning, Jacobs and Little were present.

Connecticut Telephone & Electric Company, Meriden, Conn., showed the "Connecticut" pocket meters, spark coils, switches and coil-current indicators. Among the representatives of the company present were E. C. Wilcox, E. D. Bright, B. L. Lawton, R. C. Rogers and E. V. Wilcox.

Cooper Hewitt Electric Company, New York, was represented by A. F. Hubbard, N. C. Hubbard, J. O'Shea and W. D. Evans. Mercury vapor converters, mercury vapor lamps and a large charging panel for attaching ten 14-cell batteries at once formed part of the exhibit.

Hess-Bright Manufacturing Company, Philadelphia, Pa., had Hess-Bright and D. W. F. ball bearings displayed throughout the Garden and Armory as well as auto parts mounted on its ball bearings, including shafts, transmissions, change gears, wheels, magnetos, etc. H. Hess, F. E. Bright, R. D. MacDonald, C. L. McCalla, A. Hegardt, A. Nairn and N. Hahn were in attendance.

Edison Storage Battery Company, Glen Ridge, N. J., attracted many visitors to its exhibit in the Armory. A tray of each type of cells manufactured by the company was on exhibition as well as historical cells showing the development of the Edison battery. One cell of the new improved Edison battery was also shown. W. G. Bee, E. J. Ross, Jr., and F. H. Sadler looked after the interests of the company.

Eastern Carbon Works, Jersey City, N. J., exhibited a complete line of its Eastern and Atlantic dry batteries, together with battery connectors and flash lights. E. J. Wilson, G. W. Mills and O. L. Turgeon were in attendance.

William Cramp & Sons' Ship & Engine Building Company, Philadelphia, Pa., showed samples of Parsons' manganese bronze castings, white brass castings, manganese bronze and white brass ingots, manganese bronze rods and rolled sheets. The company has space in both shows and was represented by Richard Thompson and Courtland D. Cramp.

National Battery Company, Buffalo, N. Y., showed a sparking battery and a set of twenty-four cells of 9-CB battery for electric runabouts. Battery accessories, sample demonstrating panel and photographs of installations completed the exhibit. J. R. H. Richmond, R. Kimberly, P. V. Hoyt and J. DeMallie represented the company.

National Carbon Company, Cleveland, Ohio, exhibited the Columbia dry cells, signal dry batteries, reserve dry batteries, multiple batteries, auto-cell batteries and spark coils. N. C. Cotabish, M. H. Moffett, A. E. Carrier, A. C. Henry, F. C. Park and J. C. Irvine took care of all visitors.

Rushmore Dynamo Works, Plainfield, N. J., exhibited a number of navy standard lens mirror searchlights, acetylene lens mirror searchlights and generators for automobiles, launches, power boats, etc.

Semi-Dry Battery Company, Newark, N. J., showed the Dunn semi-dry cell and batteries.

Standard Roller Bearing Company, Philadelphia, Pa.—Grant roller bearings, Standard roller bearings, ball-end thrusts, roller-end thrusts, bevel-gear automobile axles, chain-drive axles, ball and roller bearing hubs, together with a complete line of steel, brass and bronze balls, cups and cones and special ball bearings were exhibited by this company at the Armory, and at the Garden. Those in attendance included S. S. Eveland, R. H. Grant, F. Beemer, L. J. Hoover, T. J. Heller and F. M. Germane.

The Westinghouse Companies' exhibit in the Armory was in charge of E. H. Heinrichs. The following apparatus was on exhibition: Westinghouse-Schmid touring car, which has a capacity of 24 horse-power, Cooper Hewitt electric converter and mercury vapor lamps, Westinghouse D-1 air compressor for use in connection with a Morgan & Wright tire to demonstrate the utility of the compressor for filling tires with compressed air and a Westinghouse storage battery receptacle. The touring car is built in France by the Societe Anonyme Westinghouse, Havre.

C. F. Splitdorf, New York City, had on exhibition some of the "hot-stuff" Splitdorf coils used successfully for gasoline engine ignition purposes. The exhibit though small attracted much attention, the coil being shown in operation.

Morgan & Wright, Chicago, exhibited a line of their automobile tires as well as the M. & W. tape, the adhesive and good insulating qualities of which are well known to the trade. A large representation of the company was present, including C. J. Butler, A. I. Philip, C. S. Shugard, T. R. Burton, W. C. Marion, Jr., A. Measure, R. G. Kennedy, J. C. Weston, J. J. Alexander, E. F. Jackson, E. M. Greene, G. M. Seewald, C. Measure, I. J. Cooper and G. A. Burnham.

Warner Instrument Company, Beloit, Wis., exhibited their auto-meter which shows how fast a car is traveling. The instrument is built like a chronometer. Magnetic force is used as the motive power and this acts directly on the indicating dial, which is mounted on a pivot, the ends of which ride in sapphire bearings. The revolving magnet tends to draw the dial in the direction of its revolution, this tendency being opposed by a hair spring. The greater the rapidity of the magnet's revolutions, the greater the displacement of the dial, so that even reading over the scale results. The action of the magnet on the dial being direct, there is nothing intervening to cause a variation in the reading.

Vehicle Equipment Company, Long Island City, New York, occupies spaces in the exhibition hall and basement of Madison

Square Garden. The exhibit was comprehensive, including electric vehicles of all sorts, broughams, landaulettes, victorias, station wagons, coaches, ambulances, express wagons, delivery wagons, baggage vans, brewers' trucks, dumping trucks, etc. The company builds over one hundred standard designs of commercial vehicles and in capacities varying from one to six tons. The two large exhibits naturally required a large force of attendants, among whom were R. McA. Lloyd, H. H. Havemeyer, R. W. McGinnis, P. C. Chrysler, H. D. Lloyd, H. Havemeyer, W. L. Brown, R. H. Doughty, A. Bourquardez, C. G. Rainer, C. B. Jaeger, J. R. Kinsey, T. E. Martin, A. F. Madden, A. J. Doty, E. E. Everett and F. F. Phillips. What little argument was needed to convince one of the superiority of electrically-propelled vehicles for any use whatever was easily supplied by this efficient corps.

THE BAKER MOTOR VEHICLE COMPANY, of Cleveland, Ohio, had its exhibition on the Twenty-fifth Street side of the Sixty-ninth Regiment Armory. This was the only electric vehicle company exhibiting on the main floor of the Armory show. The line of vehicles built by this company comprises imperials, stanhopes, surreys, station wagons and broughams. The exhibit was in charge of C. B. Rice, the New York representative of the company, who had a corps of assistants.

Centrifugal Boiler-Tube Cleaner.

The illustrations herewith represent a new type of cleaning head called a "three-arm rocker-arm head." It has cone cutters attached to the forward end of steel arms and star cutters at the rear end. These arms are attached to a spider and work

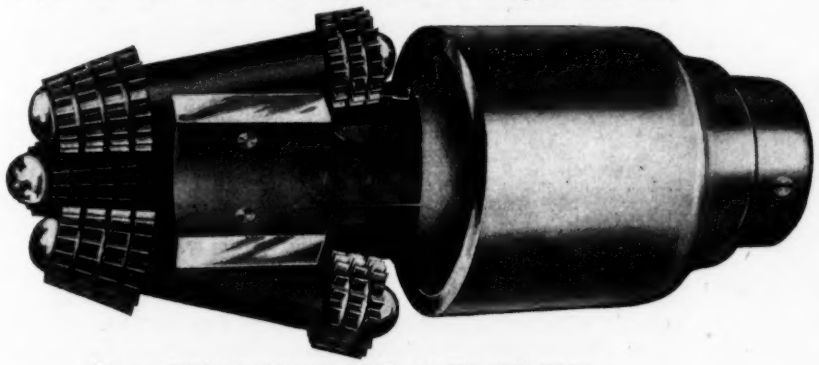


FIG. 1.—TURBINE CLEANER WITH ROCKER ARM HEAD.

on a pivot, so that they are self-adjusting at both ends, and can work in and out, according to the condition of the scale in the tubes that are being cleaned. Centrifugal action keeps the cutter against the scale with sufficient force to remove it without doing the least injury to the tubes.

The cleaning head is driven by a miniature hydraulic turbine, the particular type of turbine represented in Fig. 1, being extra heavy and strong, and therefore, suitable for very severe conditions. It is furnished with either ball or thrust bearings. The manufacturers state that tests have shown that a machine equip-

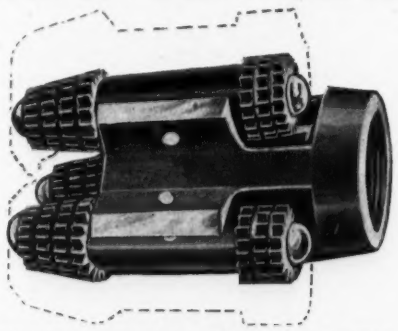


FIG. 2.—THREE-ARM ROCKER-ARM HEAD.

ped with ball bearings will run with much less friction than when supplied with any other type of bearing.

This boiler-tube cleaner is made by the Lagonda Manufacturing Company, Springfield, Ohio.

New Construction in Fibre Pulleys.

The Xylotite Product Company of Cincinnati, O., has placed upon the market two new designs of Xylotite pulleys which are illustrated herewith. Fig. 1 shows an entirely new construction

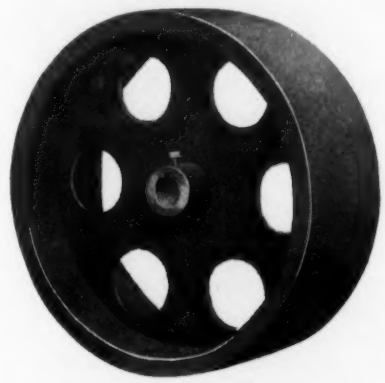


FIG. 1.—FIBRE PULLEY.

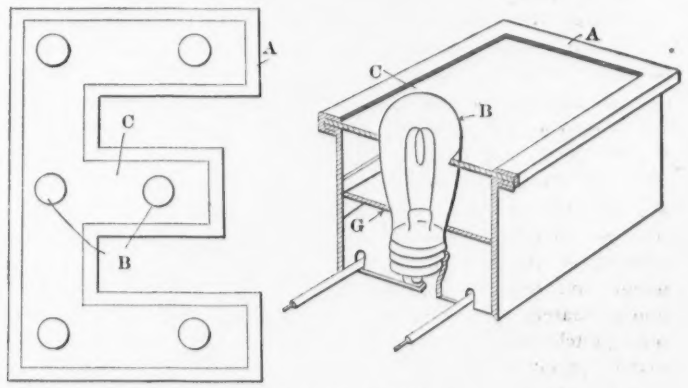
in fibre pulleys. The iron web is cast solid with the hub and the fibre rim is then glued and dowelled to the edge of the iron web, which makes a strong, light pulley, very neat in appearance, and which the manufacturers report as giving satisfaction to the customers. This form of construction is used for pulleys from 8 to 30 ins. in diameter where the face does not exceed 8 ins. Fig. 2 shows a style of pulley used by a number of manufacturers

FIG. 2.--FIBRE PULLEY.

of small motors. It is the regular Xylotite pulley with a light iron flange at one end.

Combination Electric Sign.

The illustration herewith shows the main features of an electric sign combining the bulb and transparency types. In the illustration *A* is a metal box and *C* is a translucent plate or



COMBINATION SIGN.

fabric; *B* indicates the ends of the electric lamps; and *G* is a white reflecting surface. The body of the letter is made of

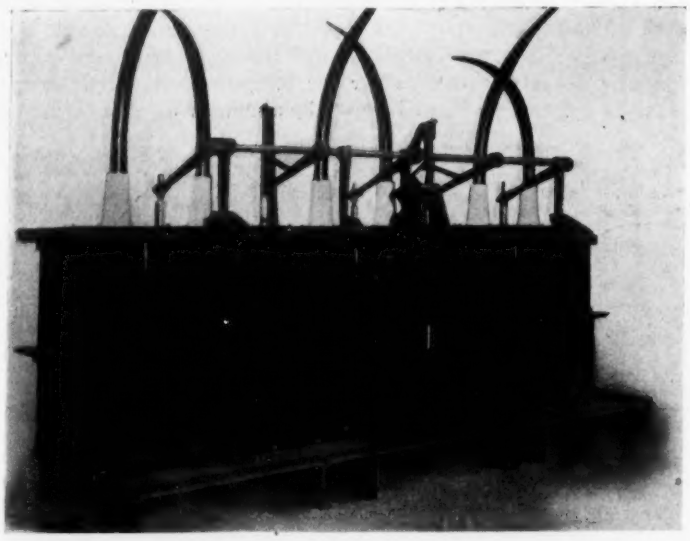
metal. The electric bulbs project slightly through the translucent face, the lower half of the bulb serving to light up this face. This effect is assisted by the partition plate at *G*, which, together with the sides of the interior, is painted white.

This electric sign is being placed on the market by the Day-and-Night Sign Company, 82 Beaver Street, New York.

Electrically-Operated Oil Circuit-Breaker.

The breaker shown in the illustration herewith was designed by the Westinghouse Electric & Manufacturing Company primarily for the Ontario Power Company's work. It is intended to handle power up to 45,000 kilowatts per three-phase circuit, and will open a circuit under any conditions of overload or short circuit which may occur with a power house capable of delivering 150,000 kilowatts. The insulation to ground and between terminals is designed to withstand a break-down test of 150,000 volts, and the insulation between poles is twice that amount, since the poles are electrically separate.

The three poles of the switch are closed together by means of a toggle joint operated by a single direct-pull solenoid. The



ELECTRICALLY-OPERATED OIL CIRCUIT-BREAKER.

switch is held in a closed position by the toggle being carried just beyond the center and is tripped out by the tripping coil armature striking this toggle and knocking it backward, allowing the switch to open by gravity. Each pole of the switch gives a double break, the length of each break being approximately 17 in. The closing magnets require approximately 5,000 watts direct current, while the tripping magnets require about 300 watts.

The oil tanks, of which there are three, are made of boiler iron lined with an insulating material with barriers interposed between the stationary contacts. The contact parts have renewable arcing tips and contacts: The leads with their insulation and the upper porcelain insulators may be readily removed from the switch, giving access to the contact parts for inspection and repairs. The top covers of the tanks are made of treated soapstone slabs, part of which are also removable. Each tank is provided with an oil drain opening in the bottom and an overflow just above the normal oil level. Each tank has an oil level gauge and requires approximately 160 gallons of oil, weighing approximately 4,000 pounds. The total weight of each three-pole switch complete, the tanks being filled with oil, is approximately 15,000 lb.

A two-pole double-throw indicating switch is provided upon each three-pole oil switch for use in connection with the controlling and indicating devices. The circuit-breaker is not automatic in itself—an overload relay operated from series transformers being necessary.

Hawaiian Electric Pumping Installation.

On page 444 of the issue of *Electrical World and Engineer* for September 9, 1905, there was given a description of the electric pumping plant which the Makee Sugar Company was installing at Keila, on the island of Kanai, Hawaiian Territory. Since the publication of that description, several changes have been made in the plans of the company, and an account of the work is given below. It was the original intention to use at the pumping station a synchronous motor, which would require a 50-hp motor for starting, as well as an exciter, controllers and apparatus for throwing the starting motor in or out; but it was found that the system could be simplified by the use of an induction motor. The operation of the plant remains otherwise practically the same, and of course the induction motor requires neither a starting motor nor exciter but merely controlling apparatus. The efficiency of the whole plant will be the same with an induction motor as with a synchronous motor, while in simplicity of construction, reliability of operation, small amount of attention required and also in the matter of first cost the induction motor has the advantage.

The pumping plant will be located five miles from the power station. The driving induction motor will be a Bullock machine rated at 225 hp, and will be connected through a rope transmission to a duplex, double-acting Riedler pump, having a capacity against 250 ft. head ranging from 1,750 to 2,800 gal. per minute, according to the speed at which the pump is driven. The speed of the pump, operated at its full capacity, will be 116 r.p.m. It is to be extra heavy and furnished with Allis-Chalmers latest improved mechanically-operated pump valves. The variation in the speed of the pump will be obtained by varying both the voltage and the frequency of the current supplied to the induction motor.

The power station will contain a 300-kw, three-phase Bullock alternator, which when driven at the normal speed of 450 r.p.m. will deliver 60-cycle current. The primary driver will consist of a specially designed Pelton impulse water wheel, operating under a fall of 400 ft. of water conveyed in penstock pipes from a mountain stream and delivering its power continuously to the generator, direct connected, at six different speeds, which are secured by the use of six different sets of buckets arranged on wheels of varying diameters. The generator will have its exciter direct connected to it, and the exciter has been so designed that it can deliver the full voltage and current required for excitation even at the minimum speed. By means of an automatic regulator, the exciter voltage will be maintained constant at all speeds of rotation, and it will, therefore, be unnecessary to change the adjustment of the generator rheostat when the speed of rotation is changed. In addition to the automatic regulator, a hand-operated field regulator will be installed for use in an emergency. As both the frequency and the voltage change in the same ratio, the induction motor will at all times be operating with constant magnetic flux.

This method of varying the capacity of the pumping equipment has been adopted by Mr. Z. S. Spaulding, president of the Makee Sugar Company, as conforming closely to the requirements of variations in the available power at the different seasons On account of the limited amount of power, it is desirable to utilize, as far as practicable, the maximum water supply at all times The head being constant, the velocity of the water at the delivery nozzle is constant, and the power varies directly with the power supply. By changing the dimensions of the wheel carrying the buckets, the rotative speed of the generator is changed, while the speed of the water remains constant at all times, and the maximum efficiency is obtained from the water wheels.

It may be of interest in this connection to mention that the Hawaiian Islands lead the world in high pumping irrigation. We are informed that the Allis-Chalmers Company, which furnished the above described electrical and pumping machinery, has supplied 32 different irrigation pumping machinery equipments to Hawaiian companies. These equipments vary in capacity from 2,000,000 to 12,800,000 gallons per 24 hours, and operate under heads varying from 35 to 775 ft.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Activity continues in manufacturing lines, particularly iron and steel, machinery and kindred industries, and as regards prices in finished products there is an advancing tendency. The continuance of mild weather favors outdoor activity, which is reflected to a large extent in the sustained demand for building materials. Railway lines are doing a large business, and the shortage of cars is not so acute. Fair to good collections are reported and money is easier, with a good demand. In jobbing and wholesale lines the feature is the call for prompt shipment of spring goods. There is a strong undertone in the iron and steel market. The Steel Corporation will make extensive additions to its plants, particularly in the Pittsburg and Youngstown districts. Contracts for structural shapes are of moderate proportions, but some heavy business is pending. During 1905 the United States Steel Corporation produced 10,175,000 tons of pig iron and 11,995,000 tons of ingots. This surpasses the output of 1902 when the total was 7,975,500 tons and 9,745,000 tons, respectively. The machine tool and machinery trades report a good outlook, the largest demand coming from the railroads. The market for refined copper was more irregular for future delivery. Claims are still made for further advances, but certain interests state that the best prices have been reached. Lake and electrolytic is quoted at 18⅞, and casting stock 18⅝. Cotton is stronger in tone and the cotton goods market is somewhat stiffer. The business failures for the week ending January 11, as reported by *Bradstreet's*, aggregated 286, against 220 the week previous and 295 during the corresponding week last year.

ROSSITER, MACGOVERN & COMPANY EXTEND THEIR SCOPE.—The firm of Rossiter, MacGovern & Company has been organized and will extend its activities to the field of engineering and contraction, making a specialty of steam and electric railway and power plant work. The capital of the company has been doubled, being largely supplied by the new president of the company, Mr. J. C. Brackenridge, formerly chief engineer and manager of the Brooklyn Rapid Transit Company, and lately Commissioner of Public Works of Brooklyn. Mr. Frank MacGovern will continue as vice-president and general manager. Mr. Clinton L. Rossiter, who retires as president, will remain a member of the executive committee. Rossiter, MacGovern & Company have enjoyed a most prosperous career since they commenced business, about fourteen years ago, for the purpose of purchasing and selling electrical and steam apparatus. The business increased so rapidly that it became necessary to incorporate the firm seven years ago. During recent years the amount of the company's sales of electrical apparatus has been exceeded by that of few if any of the electrical manufacturing companies in the country outside of the very largest. As an adjunct to its business, the company established sometime ago a repair shop in Jersey City and offices in St. Louis and Boston. The plans of the company to engage as engineers and contractors will not interfere with its present well established business of the purchase and sale of electrical and steam apparatus of all kinds. In fact, the company proposes to erect another large repair shop in the neighborhood of New York, on the water front, to replace the present shop in Jersey City, but the location of this shop has not yet been decided upon. The board of directors includes J. C. Brackenridge, Frank MacGovern, Clinton L. Rossiter, D. H. Valentine (director of B. R. T.), and Edward Rossiter (treasurer N. Y. C. & H. R. R. R.).

NORTHERN CALIFORNIA POWER.—A vast project to take up the water of Feather River in northern California, and carry it through tunnels and aqueducts for the development of 400,000 horse-power or enough to supply all the towns of the Sacramento Valley, Oakland, Alameda, and Berkeley with electrical power, is the purpose of a $50,000,000 corporation, organized by I. Brown Wilson & Co., of New York and San Francisco. The corporation is backed by F. H. Ray, Edwin Hawley, and A. C Bedford, all prominent in the financial world of New York city, and the project is but the nucleus of a vast plan of similar projects which will extend through Oregon and Washington, and for which $100,000,000 is to be set aside. From the head of the Sacramento Valley, power will be transmitted through the valley and to San Francisco by means of two-pole lines, 175 miles in length.

SHAWINIGAN POWER.—United States Consul Worman, of Three Rivers, reports that the North Shore Power Company has been absorbed by the Shawinigan Water & Power Company, an electrical enterprise largely capitalized by Americans and Belgians. The Shawinigan Falls, where this company has its works, rank next to the falls of Niagara in importance as a Canadian water power. Not a tenth of its capacity is at present utilized. The absorption of the North Shore Company by the Shawinigan Falls Company means the reorganization of that company's affairs and the broadening of its enterprises. Besides the railway now building to connect Shawinigan Falls and Grand Mer with Three Rivers, there will now be started a system of trolleys for the district.

THE CHICAGO PNEUMATIC TOOL COMPANY states that on account of the compressor business being offered exceeding its manufacturing capacity (amounting to only 400 compressors during the year 1905) that arrangements are now under way for increasing the capacity of its compressor works at Franklin, Pa., so as to give it an annual output of between 650 and 700 compressors. The machines of its manufacture are gradually taking the lead, thus necessitating increased facilities for taking care of the business offered. A large volume of business was lost to the company during 1905 on account of inability to make deliveries.

CONSOLIDATION IN BALTIMORE.—It is rumored that the proposed change in control of the United Railways & Electrical Company, of Baltimore, will be followed by the consolidation of the United Railways Company, the Consolidated Gas, Electric Light & Power Company and the Baltimore Electric Light & Power Company under the charter of the Maryland Securities Company, organized in 1902, which has remained dormant since then. The United Railways & Electric Company now controls all the street car lines in Baltimore and the neighboring county.

BISHOP GUTTA-PERCHA COMPANY.—At a meeting of the stockholders of the Bishop Gutta-Percha Co., held at the office of the company, 420 East 25th Street on January 10, the following persons were elected directors: Messrs. Henry A. Reed, Wm. Boardman Reed, Henry D. Reed, Louis F. Reed, Ellen I. Anderson. Mr. Henry A. Reed was elected president and treasurer, and Mr. Wm. Boardman Reed vice-president. Mr. Louis F. Reed was appointed secretary and Mr. Henry D. Reed, superintendent. The usual semi-annual dividend of 5 per cent was declared.

SIGNALS ON NEW YORK CENTRAL.—The New York Central Railroad Company has, according to advices from Rochester, awarded to the General Railway Signal Company of that city a contract for interlocking and block signals amounting to $2,000,000. This will tax the capacity of the Rochester plants for eighteen months. The equipment is intended for the zone of electric motive power extending about twenty-five miles from the Grand Central Station. The system of signals is the most comprehensive ever devised by any railroad.

NEW RUBBER CONCERN.—At Trenton, N. J., on January 6th, the Continental Rubber Company of America, was incorporated with an authorized capital of $30,000,000. The company is to produce rubber and manufacture rubber materials. The incorporators are Henry A. Bingham, Thomas W. B. Middleton and Cornelius A. Cole, all of Jersey City. It is understood that this company has very heavy financial backing, and will develop new rubber sources.

INDUSTRIAL BUILDINGS.—Mr. J. G. Rossman, in the Atlanta (Ga.) *News*, has been advocating industrial buildings for Southern cities, equipped with power. He says: "I have arrived at my conclusion from a long experience in dealing hand-to-hand with the class of small manufacturers who would welcome such buildings and includes my observations in Seattle, St. Louis, Boston, Baltimore, etc. I find that the demand is urgent in all sections of the country. In my work in the South recently in developing water power enterprises and electric power companies I have been especially impressed by the crying demand for this work in the larger cities."

THE GREEN FUEL ECONOMIZER COMPANY, of Matteawan, N. Y., some time ago began the manufacture of fans, blowers and exhausters upon a large scale. Recent sales are listed below. Two 310-in. induced draft fans to the American District Steam Heating Company, of Minneapolis, Minn.; a 280-in. heating and ventilating fan and heater for Kimberly & Clark, Kimberly, Wis.; two ventilating fans for Public School No. 85, New York City; two ventilating fans for the Farr Alpaca Company, Holyoke, Mass.; a forced draft fan for the Buckeye Engine Company, Providence, R. I.; an induced draft fan and engine for George E. Kunhardt, Lawrence, Mass.; a forced draft fan and engine for the Standard Silk Company, Phillipsburg, N. J.; a heating and ventilating fan for Public School No. 71, Queens, New York; a forced draft fan for Hind & Harrison, Clarks Mills, N. Y.; heater coils for the Gilbert Paper Company, Menasha, Wis.; heater coils for Shea, Smith & Co., Chicago, Ill.; a planing mill exhauster for the Whiton Machinery Company, Whitonville, Mass.; a volume blower for the Chandler Planer Company, Fitchburg, Mass.; two induced draft fans to the Delamar Copper Company, Chrome, N. J.; heater coils for the Saginaw Valley Traction Company, Saginaw, Mich.; an economizer, induced draft fan and engine to the Massachusetts Chemical Company, Walpole, Mass.; two sets of heater coils and ventilating fans for the Atlas Wire Company, South Bartonville, Ill.; an induced draft fan and engine for the Trojan Laundry Company, Troy, N. Y.

POWER IN VANCOUVER.—An important order recently secured by the Canadian Westinghouse Company was obtained from the Vancouver Power Company, of Vancouver, B. C. This order included a 1,500-hp, 2,200-volt, revolving-field, engine-type generator, which will be direct-connected to a Pelton water wheel. This is a duplicate of the generators now in operation in the power plant of this company and will operate in multiple therewith. The order includes switchboards and air-blast transformers of 550 kw capacity. There is also included in the order a 1,000-kw, 60-cycle rot ry converter to operate at 550 volts. This converter will furnish power for railwa work.

ROBINS CONVEYORS.—The Robins Conveying Belt Company has recently opened an office at 749 Railway Exchange Building, Chicago, Ill. Mr. C. Kemble Baldwin, the chief engineer of the company, is in charge of this office and is prepared to handle all inquiries from parties in the Middle West. The Robins Company has entered an order for a 30-in. conveyor for a gold dredge in the Oroville District, Cal. Among other orders on hand is one for a 24-in. and an 18-in. conveyor from the Pratt & Whitney Company, of Hartford, Conn., and one for a mast and gaff rig from the Pawtucket Gas Light Company, of Pawtucket, R. I.

LIGHTING WELLAND CANAL.—A conspicuous departure in the lighting of canals is that of the Welland Canal near St. Catherine, Ont. Over 600 alternating-current series arc lamps have been provided by the Canadian Westinghouse Company and these have been in operation for the past few months and have given splendid service. This installation as a whole redounds great credit to the Ontario government, as well as to the consulting engineer, Mr. R. J. Parker, under whose direction the complete plant was installed.

DEMAND FOR STORAGE BATTERIES.—It is stated that the business of the Electric Storage Battery Company, continues on the same large scale as last year. The Louisville & Nashville Railroad recently placed a large order and a large business has also developed with the steel mills, the company having secured large contracts from the Carnegie Steel mill in Youngstown, O., and the Illinois Steel Co. at Chicago.

THE GOLDEN KEY MINING COMPANY, Hillside, Ariz., is installing a power plant to operate its mining machinery. Contract has been closed for two of the well-known "Hornsby-Akroyd" oil engines of 16 hp each, built by the De la Vergne Machine Company, of New York.

LARGE COPPER ORDER.—It is stated that for its electrical work the New York Central Railroad system has closed contracts for 2,000,000 lb. of copper wire at 21c. per lb. When the plans were drawn up calling for the use of this wire, the market was between 15 and 16c.

CATALOGUES WANTED.—The Adirondack Hardware Co., G. L. Starks, manager, at Saranac Lake, N. Y., has opened an electrical department, which would like to receive catalogues, circulars, quotations, etc., and other data from manufacturers of electrical supplies and apparatus.

Financial Intelligence.

THE WEEK IN WALL STREET.—Easier money and favorable reports about railway and industrial properties gave rise to decided activity on the stock market, with resultant further advances in stock values. There was a wide expansion of speculation. The principal features were the large advances in iron stocks as well as in minor industrials and railroad specialties, and United States Steel shares showed further activity with higher quotations than they have reached since the present bull market began. Electric and traction securities were weak and somewhat neglected and prices tended downward. Allis-Chalmers common lost ¼ point net, closing at 23⅛, but preferred made a net gain of ¾ point and closed at 63¾. General Electric closed at 179, a decline of ½ point, and Westinghouse common and preferred at 174⅛ and 188, respectively, these quotations representing fractional gains. Brooklyn Rapid Transit closed at 91½, a net decline of 2½ points, and Metropolitan Street Railway at 125⅝, which is a gain of 1⅜ points. Western Union's last quotation was 93¼ and American Telephone & Telegraph closed at 136½, a net loss of 1¼. American Locomotive closed at 76⅜ for common and 119⅝ for preferred, the former being a decline of 1⅜ points and the latter a gain of 2⅛. Interborough Rapid Transit made a net gain of 1 point on the curb market, closing at 233. Mackay Companies is quoted at 58¾. The curb market was quiet early in the week, but developed considerable activity toward the end. Movements in the copper group were irregular and it is stated that insiders would rather sell than buy. Following are the closing quotations of January 16:

NEW YORK

	Jan. 9	Jan. 16		Jan. 9	Jan. 16
Allis-Chalmers Co.	23	23⅛	General Electric	178¼	178
Allis-Chalmers Co. pfd.	62	63¾	Hudson River Tel.	...	...
American Dist. Tel.	37	37	Interborough Rap. Tran.	232¼	233¼
American Locomotive	76	76⅜	Mackay Cos.	58¾	60
American Locomotive pfd.	117	119	Mackay Cos. pfd.	73	74
American Tel. & Cable	90	91	Marconi Tel.	...	...
American Tel. & Tel.	136	138	Metropolitan St. Ry.	124⅜	126⅛
Brooklyn Rapid Transit	88⅜	90⅜	N. Y. & N. J. Tel.	...	...
Electric Boat	28	28	Western Union Tel.	93¼	93¾
Electric Boat pfd.	65	65	Westinghouse com.	172	170
Electric Vehicle	15	15	Westinghouse pfd.	...	...
Electric Vehicle pfd.	21	21			

BOSTON

	Jan. 9	Jan. 16		Jan. 9	Jan. 16
American Tel. & Tel.	136¼	138⅛	Mass. Elec. Ry. pfd.	63⅛	69
Cumberland Telephone	...	117	Mexican Telephone	...	...
Edison Elec. Illum.	...	250	New England Telephone	134⅛	137⅝
General Electric	...	...	Western Tel. & Tel.	13	15
Mass. Elec. Ry.	18⅛	18⅝	Western Tel. & Tel. pfd.	94	..

PHILADELPHIA

	Jan. 9	Jan. 16		Jan. 9	Jan. 16
American Railways	52	52	Phila. Electric	7⅝	8⅛
Elec. Co. of America	12	12	Phila. Rapid Trans.	32	32⅝
Elec. Storage Battery	82	83	Phila. Traction	...	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Jan. 9	Jan. 16		Jan. 9	Jan. 16
Chicago City Ry.	198	197	National Carbon	79	80¼
Chicago Edison	...	...	National Carbon pfd.	115	117
Chicago Subway	...	...	Union Traction	...	..
Chicago Tel. Co	...	...	Union Traction pfd.	...	..
Metropolitan Elev. com.	27	28			

MINNEAPOLIS GENERAL ELECTRIC.—Note was made in these pages recently of the personal changes in the management of the Minneapolis General Electric Co. The directors of the company have declared an initial dividend of $2 per share on the common stock, in addition to the usual 3 per cent semi-annual dividend on the preferred stock. The company is under the management of Stone & Webster, who by careful and aggressive direction have taken advantage of the growth of the city of Minneapolis and developed the business of the company so that it shows earnings for the 12 months ending November 30, 1905, of $724,000 gross and $352,000 net. During this time the company has added largely to its power facilities and distributing system. Over $500,000 has been expended out of the earnings in these improvements and the balance of the money needed has been raised by the issue of additional preferred stock from time to time, and by the sale of escrow bonds.

MONEY FOR SUBWAYS around New York City is likely to be required in large blocks in the near future. The total cost of the proposed three new subway systems—the 7th and 8th Avenue line, the Lexington Avenue line, and the Third Avenue line—is estimated at approximately $100,000,000. This total covers only that part of these lines on Manhattan Island. The extensions in the Bronx will cost about $15,000,000, construction being not so expensive. The existing subway cost originally $35,000,000, but the additions of tracks and changes in plans caused an additional expense of nearly $15,000,000 making the entire cost nearly $50,000,000.

SAN FRANCISCO CONSOLIDATION.—The merger deal has been closed, which accomplishes the absorption of the San Francisco Gas & Electric Company by the California Gas & Electric Corporation, together with financial interests represented by N. W. Halsey & Co., New York bankers. On January 2 the purchasers paid the Union Trust Company, of San Francisco, as trustee for the San Francisco Gas & Electric stockholders, $3,151,000 cash. There was also turned over under the terms of the sale $9,000,000 of preferred stock and $9,250,000 in the new 5 per cent 30-year gold bonds of the Pacific Gas & Electric Company, which has been incorporated by the purchasers as a holding company. N. W. Halsey & Co. receive some of this company's stock for having advanced the $3,651,000, which includes the $500,000 forfeit money deposited with the Union Trust Company when the option was taken on the properties purchased. San Francisco Gas & Electric stockholders get $90 a share, $25 in cash and $65 in the new bonds. The Union Trust Company, as trustee for the stockholders, is to have two directors in the new company, the California Gas & Electric Corporation, and also in the San Francisco Gas & Electric Company. The San Francisco Gas & Electric Company has elected a board of directors. John A. Britton, who is also the president of the Pacific Gas & Electric Company, was elected president and F. G. Drum, vice-president. Charles L. Barrett, secretary and treasurer under the old ownership, were re-elected by the new management. This company will retain its individuality as the local system in San Francisco. The Pacific Gas & Electric Company is now one of the largest and most important public utility corporations in the world. It will operate in 18 counties, serving a territory 250 miles long by 125 miles wide and controlling vast water powers and the longest electric transmission line in existence. Plans are in preparation for enlargements and improvements in the gas and electric plants in San Francisco and through the State. The completion of the French Creek power plant, of the Valley Counties system, on which work has been suspended for more than a year, will be rushed this season.

DIVIDENDS.—The International Steam Pump Company has declared a regular dividend for the quarter of 1½ per cent on the preferred stock, payable February 1. The Milwaukee Electric Railway & Light Company's directors have declared the regular quarterly dividend of 1½ per cent, payable January 31. The Edison Company, of Boston, has declared a regular quarterly dividend of 2½ per cent, payable February 1. Directors of the Chicago Edison Co. have declared the regular 2 per cent quarterly dividend, payable February 1. The Electric Co. of America has declared the regular semi-annual dividend of 35c. per share, a rate of 7 per cent per annum, payable January 31. The National Steel & Wire Co. of New Haven has declared the regular quarterly dividend of 1¾ per cent on the preferred stock. The Grand Rapids Railway Co.'s directors have declared the regular quarterly dividend of 1¼ per cent on its preferred stock, payable February 1. Minneapolis General Electric Co. has declared a dividend of 2 per cent on the common stock, in addition to the 3 per cent semi-annual on the preferred. The Jacksonville Electric Company has declared a semi-annual dividend of $3 per share on the preferred stock and $3 per share on the common stock, payable February 1. The Westfield Power Company has declared a semi-annual dividend of 2½ per cent. The directors of the Electric Bond & Share Company has declared the regular preferred quarterly dividend for the three months ended December 15, 1905, and an additional 1¼ per cent dividend for the period from December 15, 1905, to February 1, 1906, payable February 1. Directors of the American Light & Traction have declared the regular quarterly dividend of 1½ per cent on preferred stock and 1 per cent on the common, payable February 1. The American Graphophone Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable February 15. The Central District Printing & Telegraph Company has declared a dividend of 2 per cent, payable January 31. Directors of the Butte Electric & Power Company have declared the regular quarterly dividend of $1.25 on the preferred stock, payable February 1.

LONG ISLAND HOLDING COMPANY.—The Long Island Consolidated Electrical Companies, the entire capital stock of which is owned by the Long Island Railroad, has been organized as a holding company for the purpose of taking over the control by the latter company, as well as such other electric railways as may be purchased or constructed as feeders to the lines of the Long Island Company in the near future. An authorized issue of 4½ per cent 40-year collateral trust mortgage gold bonds, not to exceed in the aggregate the amount of $10,000,000, is designed to cover the cost of acquired and constructed subsidiary electric roads, and to provide for the future development and extension of these and similar properties. The following electric railways are to be turned over to the Long Island Consolidated Electrical Companies: Huntington Railroad Company, Ocean Electric Railway Company, the Northport Traction Company, the Nassau County Railway Company, the Glen Cove Railroad Company, and the Jamaica & South Shore Railroad Company. The Long Island Company also owns one-half of the capital stock and bonds of the New York & Long Island Traction Company, and will acquire one-half of the capital stock and bonds of the Long Island Electric Railway Company, at a total cost of $1,360,507. These securities are also to be turned over to the Long Island Consolidated Electrical Companies.

THE UNION ELECTRIC LIGHT AND POWER COMPANY, of St. Louis, one of the local public service corporations owned by the North American Company, has issued $4,000,000 in new securities through an underwriting syndicate. The new security is a collateral trust note, drawing 5 per cent interest, and running for three years. It is secured by $4,000,000 of the capital stock of the Union Company deposited with the Mississippi Valley Trust Company, as trustee. The notes have a form of guarantee by the North American Company in which the parent corporation pledges itself to buy the stock in at par on the expiration of the notes. The notes are being sold principally in New York. The collateral for the notes increases the stock of the Union Company to $8,000,000, out of an authorized capital stock of $10,000,000. The company has a bonded indebtedness of $25,000,000. The money from the sale of the notes was put into new improvements in the power plants. Most of it was used in completing the new Ashby Street power house.

OKLAHOMA LIGHTING BONDS.—Proctor & Borden, Equitable Building, New York City, are offering $100,000 of Oklahoma Gas & Electric Company, Oklahoma City, first mortgage 5 per cent gold bonds, subject to call at 105 and interest. They are part of a total authorized issue limited to $300,000, reduced by action of the sinking fund to $290,000, and secured by first mortgage on the property of the company, and followed by an authorized issue of $1,000,000 general mortgage 5s, of which $514,000 are now outstanding. Sufficient of the general mortgage bonds are reserved to retire the first mortgage bonds at maturity. Of the general mortgage bonds, $225,000 are owned by the Electrical Securities Corporation, a subsidiary corporation of the General Electric Company, and deposited as part security for the collateral trust bonds, the property on which the first mortgage bonds are secured, representing a cash investment of over $600,000. The net earnings for the calendar year ending December 31, 1905, are equal to over six times the annual interest on the first mortgage bonds.

KEYSTONE TELEPHONE.—The Keystone Telephone Co.'s report submitted to stockholders at the annual meeting showed the following for the fiscal year ended December 31, 1905: Gross earnings, increase, $64,795, and net earnings, increase, $18,588. There was expended in extension of the plant in 1905 a total of $639,370. The total credit to profit and loss December 31, 1905, is $292,578. There are over 19,000 telephones in use in and around Philadelphia, and it is expected to add 6,000 in 1906. Two hundred and seventy miles of conduits are owned. The year ended December 31 shows as follows:

	1905.	1904.	1903.
Gross	$719,745	$654,950	$468,860
Expenses	444,041	397,834	235,100
Net	$275,704	$257,116	$233,760

PHILADELPHIA COMPETITION.—As to new lighting competition in Philadelphia, the member of a prominent Philadelphia brokerage house says: "The now assured competition for the Philadelphia Electric Co. is indicative of the calling of another assessment of $2.50 per share, and I believe the recent selling of the stock and the subsequent low price has been by inside people who do not care to pay another assessment. I am told that there is an order in the market to dispose of 35,000 shares of this stock for an influential financial interest in the company and that a portion of this order has already been executed."

BLOOMINGTON, ILL., PROPERTIES.—Hodenpyl, Walbridge & Co. have sold the Bloomington and Normal Street Railway, Heating and Lighting system of Bloomington, Ill., to the McKinley syndicate for $1,000,000. The syndicate is building and operating interurban lines throughout Illinois. It already owns the Consumers' Heat and Light system and the interurban franchises in Bloomington.

General News.

PRAIRIE GROVE, ARK.—The electric light plant was suspended January 1, after being in operation only about three months. The reason assigned is lack of patronage.

LOS ANGELES, CAL.—The People's Gas Company, of Monrovia, has been purchased by the Edison Electric Company for $30,000.

SAN BERNARDINO, CAL.—The Hill Street power plant of the San Bernardino Electric Company has been destroyed by fire. The loss is estimated at $65,000.

LOS ANGELES, CAL.—The Pacific Light & Power Company and the Edison Electric Company have announced lower flat rates. Meter rates are reduced from 15 cents to 11 cents per kw-hour.

NAPA, CAL.—The trustees of St. Helena have granted a franchise to I. N. Enright and Raymond Benjamin for an electric light and power line system. Bids for the franchise will be opened in February.

LOS ANGELES, CAL.—Messrs. Phillips and Torrance, directors of the Home Telephone Company, of this city, have acquired a 50-year franchise from Oakland for the Home Telephone Company, of Alameda County, paying therefor $32,500.

BAKERSFIELD, CAL.—A number of canal and irrigation companies have commenced an action in the Superior Court to restrain the Edison Electric Company, the California Power Company, and other allied interests from obstructing the water of Kern River by a dam in the stream.

SISKIYOU, CAL.—The Siskiyou Electric Power Company is connecting up the Fall Creek and Shasta River plants in order to supply the increased demand for power. The survey just completed over the 1,500 acres recently purchased by the company gives a 160-foot fall in 6,600 feet and the water supply is sufficient to develop approximately 100,000 horsepower. The company has refused the city of Ashland an extension of the fifteen days' option at $65,000 for the purchase of the local plant.

SAN FRANCISCO, CAL.—At the annual meeting of the stockholders of the Golden State Power Company the following-named officers were elected for the ensuing year: A. S. Macdonald, president; Joseph D. Redding, vice-president, and Rothwell Hyde, secretary. The company owns all the original water rights on the North Fork of the Feather River, extending from Big Bend, Butte County, to Big Meadows, Plumas County. The company is said to be planning a development of 200,000 horse-power.

WINDSOR LOCKS, CONN.—Electric lighting for the Burnap Opera House has been furnished by the dynamo recently installed by G. W. Gates to light his store.

WATERBURY, CONN.—Instead of an electric lighting plant as suggested in the Mayor's message, the Waterbury *Republican* proposes that the city government should establish a public heating plant.

SOUTHPORT, CONN.—There is growing favor in the project to utilize Mill River to furnish motive power for an electric light plant for lighting the town and business places under municipal ownership.

NEW MILFORD, CONN.—The New Milford Electric Light Company is the defendant in a suit brought by the town of New Milford for damages alleged to have been made to the highway on the west bank of the river by the construction of a new dam by the lighting company. The sum mentioned in the suit is $10,000. The new dam was completed about a year ago, and replaced an old wooden structure.

WINDSOR LOCKS, CONN.—The local electric lighting station met with a serious mishap last week by the independent starting up of the water wheel when nobody was at the station. This did considerable damage before it was discovered. The damage to engine and other machinery and the fire loss will require about $3,000 to replace. The company supplies lights for streets and domestic service for Windsor, and the villages of Warehouse Point and Broad Brook across the river.

DENVER, COL.—The plant of the Lacombe Electric Company was partly destroyed by fire Jan. 8. This plant supplies the street lighting of Denver and some incandescent lighting, especially in the residence districts. It is expected that street lighting service can soon be resumed, although the incandescent lighting apparatus was disabled. The Denver Gas & Electric Company helped make up for lack of light on the downtown streets by keeping its flat rate sign and window display lighting on all night instead of turning it off at midnight as usual.

KOKOMO, IND.—J. W. De Haven writes that a stock company is being organized to construct a dam in Wild Cat Creek for light and power purposes.

WASHINGTON, IND.—The Bell Telephone Company is starting the building of a line from Vincennes, Ind., to Olney, Ill., and thence to Effingham and Mattoon, Ill.

CAMBRIDGE CITY, IND.—James A. and Charles A. Boyd, owners of the Independent Telephone Exchange of this city, have purchased the Hagerstown independent telephone plant. The system comprises nearly 2,000 instruments.

SOUTH BEND, IND.—President Thorwood of the South Bend Telephone Company announces that his company is to be merged into a corporation backed by New York and St. Louis capital, which will control most of the telephone systems in northern Indiana and Ohio.

TERRE HAUTE, IND.—The Citizens' Telephone Company, of Terre Haute, has purchased a site for its new exchange at a cost of $4,500. Plans have been prepared for the erection of a three-story fireproof brick building. An elaborate switchboard will soon be installed. It is estimated that the expense of erecting and fitting the building will amount to $100,000.

FORT WAYNE, IND.—At a recent meeting of the stockholders of the Home Telephone & Telegraph Company of Ft. Wayne, it was decided to complete the purchase of the National Telephone Company, with its long-distance telephone lines in Ohio, Indiana and Michigan, and its local exchanges in Sturgis, Kendallville, Auburn and New Haven within the next sixty days.

PITTSBURG, KAN.—The Labette County Telephone Company, the Parsons Telephone Company and the Pittsburg Telephone Company, all of this State, have been merged into one system with properties aggregating over $200,000 in value. The new company will be known as the Citizens' Home Telephone Company and will probably have its headquarters in Pittsburg. George Spangler, of Chetopa, has been elected secretary. Improvements will be made and new lines built.

JASPER, KY.—Both the electric lighting and the water plants of Jasper have been purchased by the town authorities. The capacity of the lighting plant has been increased by 3,000 lights.

NEW ORLEANS, LA.—At a recent meeting of the City Council was introduced an ordinance granting to A. Von Hoffman and his associates the right to establish and maintain a telephone system in the city for a term of fifty years.

TURNER, ME.—E. L. Staples has purchased a 250-light dynamo and has installed it in his place of business, preparatory to furnishing the illumination for the stores and residences of the village.

PORTLAND, ME.—At the annual meeting of the Consolidated Electric Light Company of Maine the following officers were elected: President, Leander W. Fobes; vice-president, Charles W. T. Goding; general manager and treasurer, George E. Raymond. George E. Raymond was elected secretary of the corporation.

PORTLAND, ME.—The Maine & New Brunswick Electrical Power Company is making a large hydro-electric development at the Aroostook Falls, in the British Colony, chiefly for utilization in Maine, under surveys of Mr. B. D. Whitney, of Gardiner, Me. The consolidated company has charters from both sides of the frontier. The plant near Fort Fairfield is to develop about 2,700 hp for delivery at distant points, such as Houlton, 52 miles southward, and Van Buren, 48 miles to the north. A sale of current is estimated at $32,000 per year, with operating expenses of $7,000 and $5,000 interest on bonds. The plant will cost about $91,000, not inclusive of transmission line. The plant is to be in operation this year.

HOLBROOK, MASS.—The committee appointed to ascertain the number of lights needed and how much the cost would be to install the proposed electric light system has looked over the ground with Mr. Bailey, of the Randolph Electric Light Company, and will be ready to make its report at an early date.

SPRINGFIELD, MASS.—The United Electric Light Company plans to furnish increased power to the Boston & Albany Railroad and the United Drop Forging Company's plant for lighting and operating purposes as soon as the new Boston & Albany Railroad bridge over the Connecticut River is completed, so that larger wires can be connected up.

WEST SPRINGFIELD, MASS.—Frank L. Worthy plans to furnish electric power to operate the mills of the Warren Thread Works in Westfield from a motor in his power plant on the bank of the Westfield River at Mittineague, provided franchises permitting the erection of poles and wires are granted him by the selectmen of this town and Westfield.

MUSKEGON, MICH.—As already noted, the American Light & Traction Company has by purchase added to its list of properties the Lacomb Electric Company of Denver, Col., and the Muskegon Traction & Lighting Company, of Muskegon, Mich. The property is the more extensive and valuable of the two purchases. It consists of gas and electric plants, and a street railway system 15 miles in length. The company was incorporated and began business in 1901, as a consolidation of the Muskegon Street Railway Company, the Muskegon Gas Light Company and the Muskegon Electric Light Company. It is the terminal for the Grand Rapids third-rail system. Its net gain above expenses and fixed charges for the year ending Feb. 23, 1905, was $25,650.

GRAND RAPIDS, MICH.—The long-standing dispute over the Thornapple Electric Company's franchise has been amicably settled. M. B. Wheeler has filed his acceptance of the amended franchise.

MONROE, MICH.—The municipal lighting plant, which the voters have refused to improve or dispose of, has been shut down for lack of sufficient appropriation. It is said that the Board of Works cannot secure any more coal, as the city owes $700 for what has been used. A meeting has been called for the purpose of discussing the situation.

PORT HURON, MICH.—The Port Huron Light & Power Company announces a reduction in the rate for commercial lighting. Last spring the company made a cut in its rates for residence lighting, amounting to 20 per cent. On January 1 a differential rate was made to apply to all lighting service except resident lighting. The new rate will be 15 c. per kw-hour for the first 30 hours and 5 c. per kw-hour for all power used in excess of that amount. The present rate is 15 c. straight.

PETOSKEY, MICH.—Judge Fred W. Mayne, of Charlevoix, proposes in behalf of a syndicate to furnish electric power to Petoskey at the rate

of 4 c. per kw-hour for lighting and 2½ c. for commercial purposes, the distribution to be in the hands of the city. He also proposes to buy the Petoskey lighting plant if it should be offered for sale. The power is to be generated at a dam on the Pigeon River in Cheboygan County. Though the rate is said to be lower than that at which Petoskey can produce the power, the scheme will probably be opposed by those who believe in municipal ownership.

MARSHALL, MO.—A mass meeting was held at Marshall, January 11, in the interest of the Central Electric Railway from Miami to Sedalia by way of Marshall. The company expects to complete the road within one year.

NORMAL, MO.—The Kinloch Telephone Company is completely rebuilding its system at Normal. It has leased the second story of the First National Bank building into which it will move its exchange, which will be materially enlarged. A new switchboard with a capacity of 700 telephones has been ordered and is expected to be installed in the new exchange early this month. The board will be of the central energy type.

KIRKWOOD, MO.—The citizens are discussing a proposition to sell their lighting plant to the General Service & Development Company, said to be owned by the North American Company, and they will have an opportunity of voting on the question at a special election to be held about February 15. Two ordinances have already been drawn up and are in the hands of the City Attorney. It is understood that the contracts have been agreed upon and signed, subject to the approval of the voters. The General Service & Development Company made an offer some time ago to assume the $17,000 now outstanding on the municipal plant, which was built five years ago at a cost of $30,000, besides paying in cash the sum of $8,000. It is said that the company offered to furnish the town with its lights at $14.50 per lamp, or a total of about $3,500.

WOODBURY, N. J.—The City Council has appointed a committee to go to Trenton to urge on the Legislature the enactment of law permitting cities of the third class to erect and maintain gas and electric light plants.

TRENTON, N. J.—The Trenton, Lakewood & Atlantic Railroad Company will issue $2,500,000 bonds. While the company is chartered to build a road between Trenton and the seashore, it is said that some of this money may be used for construction work in Monmouth County.

ORANGE, N. J.—Mayor Isaac Shoenthal in his annual message recommends the early consideration of the subject of a municipal electric light plant, the city to either construct its own plant or co-operate with other cities in the establishment of a joint municipal lighting plant.

BROOKLYN, N. Y.—The consent of the new State Gas and Electric Commission to an increase of $3,200,000 in the capital stock of the Kings County Electric Light & Power Company of Brooklyn was filed in the office of the County Clerk of Kings County yesterday. With the consent is filed the petition of the company asking for permission to increase the amount of the capital stock from $5,000,000 to $10,000,000.

NEWARK, N. J.—A bill will, it is thought, be introduced in the next legislature for the installation of an experimental lighting plant by the city. The bill, as drawn by City Counsel Joseph Coult, provides that any city having an available site or sufficient power to operate it, may construct a plant for experimental or permanent lighting purposes. The bill gives such cities the authority to issue bonds to cover the cost of such a plant.

NEW LEXINGTON, OHIO.—T. J. Smith and J. B. Rhodes have been granted a telephone franchise and will incorporate at once as the Citizens' Telephone Company.

CANAL FULTON, OHIO.—An ordinance has been passed granting permission to the Massillon Light, Heat & Power Company, of Massillon, Ohio, to establish a system for furnishing electric light, heat and power in this village.

HURON, OHIO.—A sentiment seems to be growing here in favor of disposing of the town's electric lighting plant. It is claimed that the lighting plant has been a constant burden on the resources of the town and that it should be disposed of.

NEW CARLISLE, OHIO.—The proceedings brought in probate court several months ago by the Springfield & New Carlisle Telephone Company to compel the village council to give that company a franchise has been dismissed. The franchise has been granted by the new council.

COLUMBUS, OHIO.—Direct long-distance connection between independent lines of Ohio and West Virginia will be secured through an arrangement recently perfected by M. B. Overly, of the United States Long Distance Company, and the West Virginia Telephone Company. The line is already completed from Columbus to Athens and work upon its extension to Parkersburg, W. Va., will be immediately commenced.

COLUMBUS, OHIO.—The new toll board of the Columbus Citizens' Telephone Company was recently completed. It is said to be the largest switchboard for long-distance business installed in any independent plant in the country. It will have 32 operators' positions, and will start in with 60 long-distance lines, 22 Franklin County exchange connections and 60 rural and suburban connections. The company is also installing automatic telephones at the rate of 15 per day.

INDIANA, PA.—The Indiana Telephone Company suffered the loss of nearly 200 instruments by a recent fire.

DUSHORE, PA.—A committee is reported to have been appointed to look into the matter of securing a lighting system for Dushore.

PHILADELPHIA, PA.—An organized effort is to be made to have the next Pennsylvania Legislature pass a bill to give the electric railway companies the right to carry freight.

YORK, PA.—The stockholders of the Merchants Electric Light, Heat & Power Company elected these officers for the ensuing year: president, Charles H. Bear; vice-president, George C. Campbell; treasurer, Harry Wasbers; secretary, Thomas B. Loucks; directors, Albert Falk, Arthur M. Burger and W. L. Bear.

ALLEGHENY, PA.—The public works committee has ordered printed for the council an ordinance to permit Henry Phipps to lay water and steam pipes and electric wires under Rebecca Street in the First Ward. It is said Mr. Phipps' intention is to erect an electric power and heat plant, so as to furnish light and heat for his tenants in the community.

ABERDEEN, S. D.—The Grant County Telephone Company states that during the past year it has expended in improvements over $20,000 and has constructed 400 miles of line.

BONHAM, TEX.—J. W. Russell and associates, who recently obtained control of the street railway system at Bonham, are preparing to make important improvements and extensions.

HOUSTON, TEX.—The Houston Lighting & Power Company has been reorganized and its capital stock increased from $750,000 to $1,000,000. A. H. Ford, of New York, is one of the incorporators.

HOUSTON, TEX.—The original plan of building the Houston-Galveston Interurban Railway direct to Virginia Point, across the bay from Galveston, has been changed and the road will run from Houston to La Porte via Gonda. The survey for the new route is now being made.

WAXAHATCHIE, TEX.—Mercer Carter and associates, of Dallas, who are promoting the building of an interurban electric railway between Dallas and Waxahatchie, are making good progress in the preliminary work. It is said that the construction of the line is assured and that the work will be started at an early date.

PROVO, UTAH.—Amendments to the articles of incorporation of the Utah County Light & Power Company have been filed with the County Clerk. The capital stock is changed from $50,000 to $200,000, and the life of the corporation is increased from 50 to 100 years. The annual election of officers will hereafter take place on the fourth Monday in January, instead of the second Monday.

HARRISONBURG, VA.—The Blue Ridge Light & Power Company has purchased from the Virginia Power Corporation what is known as the Nicholas water power on North River, west of Fort Republic.

SEATTLE, WASH.—An ordinance applying for a franchise to operate street railway lines on Fifteenth Avenue north has been introduced in the Council by the Seattle Electric Company.

TACOMA, WASH.—Frank L. Davis, City Clerk, writes that all bids opened on December 27 for furnishing electric current for a period of 5 or 10 years have been rejected. There is some talk of the city constructing a power plant of its own. William Welsh, Commissioner of Public Works, and Mr. Davis, estimate that a system sufficient to supply the city with water and generate 6,000 horse-power can be installed at a cost not to exceed $300,000.

LOOMIS, WASH.—The water wheel for the Palmer Mountain Tunnel & Power Company's electric power plant is being put in. The company will sell the electric light in the town of Loomis on the following monthly scale: 1 16-candle-power, $1.15; 2 16-candle-power, $1.75; 3 16-candle-power, $2.25; 4 16-candle-power, $2.75; 5 16-candle-power, $3.50. Each additional light 50 cents. 1 8-candle-power, $1.00; 2 8-candle-power, $1.00; 3 8-candle-power, $1.15. Each additional light 25 cents. 1 32-candle-power, $2.00; 2 32-candle-power, $3.50; 3 32-candle-power, $4.50. Each additional light, $1.00. 1 arc light, $6.00; 2 arc lights, $10.00; 3 arc lights, $13.00.

FOND DU LAC, WIS.—The Eastern Wisconsin Railway & Light Company announces a new schedule which took effect January 1, making the base rate 12 c. per kw-hour with discounts ranging from 10 and 10 on bills of $1.25 to $9 to 30 and 10 on bills of $36 to $60.

BELOIT, WIS.—A purchase and consolidation of the electric light, gas and water companies in Beloit is being considered by A. W. Rich and T. S. Briggs, of Cincinnati, and J. J. Davis, of Anderson, Ind. Several conferences have been held and the deal is in a fair way to become consummated.

ST. CATHARINES, ONT.—H. H. Collier, solicitor for the Buffalo, Niagara & Toronto Railway, says that building operations will commence early in the spring. The line will be run from Niagara-on-the-Lake to Buffalo, through St. Davids and Bridgebury, with a branch to St. Catharines and Welland.

MANILA, P. I.—The installation of a modern telephone plant is being rushed to completion by the Philippine Telephone & Telegraph Company, Manila. A modern switchboard will be shipped from San Francisco soon, together with a force of electricians to install it. An extensive underground conduit system is half finished and the balance of the work is being rushed to completion, including a modern central office building. The Philippine Telephone & Telegraph Company was organized in San Francisco during the past year, and owns a 50-year concession granted by the Philippine Commission, after which arrangements were made to purchase the property of the Manila Telephone Company, the original system installed by the Spaniards twenty years ago. As soon as the telephone plant is completed in the city of Manila an extensive system of long-distance lines will be extended into the provinces. The company is composed of some of San Francisco's most prominent business men.

Construction News.

SELMA, ALA.—The City Council is considering the purchase of the plants of the Selma Lighting Company and the Selma Water Company.

HARTFORD, ALA.—It is proposed to soon install at the municipal electric light plant an air compressor for a deep well. J. W. Merchnon is superintendent of the plant.

POCAHONTAS, ARK.—The Pocahontas Ice & Power Company will construct an electric light plant and a 10-ton ice plant. The equipment will consist of two 25-hp boilers and one 75-kw single-phase alternator. The company has a capital stock of $25,000. Ruebel & Wells, Chemical Building, St. Louis, are engineers in charge of the construction.

SAN FRANCISCO, CAL.—Thomas Barbour, of the Risdon Iron Works, of this city, is reported to have matured his plans for the erection of a large water-power plant in Butte County, on the Feather River, two miles above Oroville. Above the dam four large barriers will be built in order that the force of the current will have been spent on these before it strikes the dam proper. From the dam the water will be carried in a concrete canal to the turbines. A conservative estimate places the amount of water in the river here at the lowest season at 50,000 inches, while others estimate as high as 100,000 inches. At the first figures, with a fall of 50 feet, the plant should be capable of 12,500 horse-power. Mr. Barbour does not intend to generate power for transmission to distant Oroville plants, but to offer it to manufacturing enterprises.

LOS ANGELES, CAL.—Two companies have been organized here having for their purpose the construction and maintenance of long-distance telephone lines over what is popularly known as the "Puget Sound Country." The Northwestern Long-Distance Telephone Company has incorporated with a capital stock of $1,500,000, of which amount $200,000 has been subscribed. With the cities of Portland, Seattle and Tacoma as centers, it is proposed to connect all of the prominent cities of the Northwest, even crossing the international boundary into Vancouver, B. C. The length of mileage at present contemplated is 2,000 miles. To do the work, the Puget Sound Telephone Construction Company has been incorporated with a capital of $200,000, of which amount $20,000 has been subscribed. The directors in both corporations are: C. H. Randall, G. K. Barrere and H. E. Rice, all of Los Angeles.

KREMMLING, COL.—The East Argentine Company is about to erect an electric power plant here at an estimated cost of $400,000.

GREEN MOUNTAIN FALLS, COL.—There is said to be a good opening here for the establishment of a large power plant. For information address F. A. Hunt, Postmaster.

DENVER, COL.—An electric railway is projected between Denver and Leadville, a distance by the route proposed of 115 miles. Lines will radiate from Leadville to various mines, and to the Horsheshoe District and Twin Lakes. The road will be equipped with the single-phase system.

CANAAN, CONN.—William Canfield is said to be interested in the establishment of two power plants in this town. One of these will be a private plant, located on Mr. Canfield's premises and will furnish light for the Canfield Building.

GROTON, CONN.—There is no barrier in the way of the erection of the new power house and all the dock accommodation sought by the borough. As regards the foundation work for the power house and boiler house, Contractor Marcus Trail, of Poquonoc, has started the excavating work.

NEW BRITAIN, CONN.—The Connecticut Railway & Lighting Company has discontinued its power plant on Chestnut Street, and all its power for lighting and traction purposes for this district is now obtained from the sub-station at Black Rock in the western outskirts of the town. Electricity is transmitted to the sub-station from the plant of the New Milford Power Company on the Housatonic River in Litchfield County. The distance is about forty miles.

HARTFORD, CONN.—Soon everything will be in readiness for the Hartford Electric Light Company to supply 10,000-volt current to the Consolidated Railway Company. A line of poles has been put in position up the river bank in East Hartford from the temporary bridge to the railroad causeway. More real estate has been acquired by the Consolidated system for the carrying out of their purpose to have a quick service between Hartford and Rockville.

HARTFORD, CONN.—It is reported that a number of park promoters are negotiating with the Consolidated Railway Company relative to the installation of a modern amusement resort, to be called "The White City," in the famous Charter Oak Grounds in Hartford. It is proposed to locate the White City between the half-mile track and the entrance to the park. It is likely that the installation of this park will require quite a good deal of new track work on the part of the railway company, but up to the present time nothing definite has been determined.

WATKINSVILLE, GA.—E. B. Thompson and associates contemplate the erection of an electric light plant.

ROCKMART, GA.—The election for bonds for an electric lighting system resulted in favor of the issue.

BUENA VISTA, GA.—The citizens voted in the affirmative for a bond issue to provide for the construction of an electric light plant. T. B. Rainey is city clerk.

BRUNSWICK, GA.—The Southern Electric, Gas & Water Company, which has the franchise for the building of an electric railway in Brunswick, announces that work on the new road will begin immediately and that cars will be in operation by June 15.

MACON, GA.—The directors of the Macon Electric Railway & Light Company have confirmed contracts for about $85,000 worth of improvements to the local system. New machinery will be installed and the capacity of the plant tripled.

HILLSBORO, ILL.—The Macoupin County Telephone Company is planning to spend $25,000 in improvements and extensions during the coming year.

CHICAGO, ILL.—A meeting of the directors of the Metropolitan West Side Elevated Railroad Company will be held in a few days, when plans for extensive and much-needed improvements will be taken up. The plans now under contemplation by the company include a new power house to cost $500,000.

BELLEVILLE, ILL.—The Belleville Retail Merchants' Association is arranging for the organization of a company among its membership for the construction of an electric light and gas plant. The plan for the erection of a plant on the part of the association was brought about by the excessive rates of the Belleville Gas & Electric Company, which had promised a reduction of its rates with the first of the present year, but refused to make any concession. A. E. Krebs is interested in the new project.

CHICAGO, ILL.—In the report recently presented to the City Council by City Electrician Carroll and City Engineer Ericson, emphasis was laid upon the statement that the most desirable uses for municipal purposes of the power now being developed at Lockport by the sanitary district would be for the operation of municipal street railways, which can use all the power that the sanitary district can furnish for twenty-four hours each day. The city's streets and municipal building can be lighted provided a disposition can be made of the power during hours when lighting is not required, which may be done if the city is given the right to dispose of power for commercial purposes during the day. Sewerage pumping stations, bridges and other minor utilities may be equipped for electrical operation, but would not to any appreciable extent serve to utilize during the daytime the released power used for electric lighting during the night. It is not considered economical or practicable to change the present water works plants to electric operation. The experts figure the drainage canal will have part of its plant developed by January 1, 1907, and will desire at that time to know what part of the power the city will take. The sanitary trustees because of the lack of knowledge regarding the cost of their plant have been unable to say how much this power will be sold for. The experts desire that it shall be given to the city at actual cost, which will probably be lower than electrical power produced by steam-driven plants. Until the Calumet channel is opened the sanitary district will be able only to produce 15,000 horse-power, but later 21,000 or 22,000 horse power. The city now has 6,700 arc street lights which will require about 7,000 horse power. This power the drainage district will deliver at 48th Street and the canal. To light the entire city requires 22,000 additional lights. For a municipal street car system it was figured that 95,000 horse-power would be necessary and in that case the city would use much more than can be produced by the sanitary district.

RICHMOND, IND.—The business of the municipal power plant has so increased within the past year as to make necessary the building of an addition and the installation of new machinery sufficient to double the present capacity of the plant.

TERRE HAUTE, IND.—The West Terre Haute Electric Light Company, a recent organization, proposes to erect and operate an electric light and power plant in West Terre Haute. In addition to lighting the city, the company will furnish power for coal-mine tipples and for other industries.

JEFFERSONVILLE, IND.—The Louisville & Southern Indiana Traction Company has purchased a site in this city upon which it proposes to build and operate a large power plant. The officials of the company state that it is the aim to furnish power and light for the numerous traction lines which it is believed will soon be running out of Jeffersonville in various directions. Work is to be started on the new plant within a short time.

NEWTON, IA.—The officials of the Newton & Northwestern Railway Company, which operates a steam line from Newton northwest to Rockwell City, have completed plans for an extension to Fort Dodge, which will be equipped for electric interurban service for passengers. The plant includes the purchase of the property of the Fort Dodge Heat, Light & Power Company, which is now operating the lighting and heating plants in that city, and also the street railway system.

SALISAW, I. T.—It is proposed to install a municipal electric light plant here.

GARDEN CITY, KAN.—A new 200-drop switchboard will be installed by the local telephone exchange in a short time. Various other improvements are contemplated by the management.

PARSONS, KAN.—R. C. Rawlings, of Chanute, is asking for a franchise for an electric railway in this city. The company he represents has secured a franchise from the Chanute Council.

AUGUSTA, KY.—An electric light plant will be erected here. For particulars address J. P. Reese, clerk of committee.

LOUISVILLE, KY.—The Cumberland Telephone & Telegraph Company, with headquarters at Nashville, Tenn., will build two lines between this city and New Orleans at an estimated cost of $450,000.

DAWSON SPRINGS, KY.—Reports state that the New Century Hotel Company will enlarge its electric light plant in order to furnish the town with light. Both arc and incandescent lamps will be supplied.

OWINGSVILLE, KY.—A. W. Morrison, of Montreal, Can., E. B. Carr, of Philadelphia, and William A. Young, of Morehead, have been granted franchises to build an electric railway 23 miles in length through this county.

NEW PROVIDENCE, KY.—The Clarksville Electric Light Company has received the contract for wiring the buildings of the Odd Fellows' Home, at New Providence, Ky., which is to be equipped with a complete system of electric lights.

LOUISVILLE, KY.—Ebenezer Howes, of Utica, is said to be interested in an attempt to organize a company to build an electric railway from Utica, Ind., to the line of the Louisville & Southern Indiana Traction Company, connecting Jeffersonville and Jasper. The proposed line will be eight miles in length.

LOUISVILLE, KY.—Improvements and extensions involving the expenditure of not less than $750,000, and possibly $1,000,000, are to be made by the Louisville Railway Company this year. The plans as outlined in a general way comprehend the addition of a storage battery to the power equipment, the installation of two turbines, the extension of the Eighteenth Street line four miles beyond its present terminus, the probable extensions of all the interurban lines of the company and the building of ten miles of new lines in the city.

ALGIERS, LA.—The Algiers Railway & Lighting Company has let to the New Orleans Engineering Company, of New Orleans, La., the contract for building a line from Gretna to Algiers, a distance of four miles. Leigh Carroll is president of the railway company.

WATERVILLE, ME.—John A. Jones, of Lewiston, has commenced surveying here for an electric railway to be constructed in the spring between Waterville and Shawmut.

NEW PORTLAND, ME.—Reynolds Bros., of Winslow, Me., have bought two of the mills at the North and it is expected that the water power will be fully developed in the spring.

EASTPORT, ME.—About $2,000 worth of new machinery and supplies has been recently received at the plant of the Eastport Lighting Company in this city for the improvement of its system.

ELLSWORTH, ME.—Title to the lower dam on Union River has passed from the Ellsworth owners to the Bar Harbor & Union River Power Company, W. H. Burten, of Boston, president of the company, having exercised the option held on the property, and paid over $12,000.

PORTLAND, ME.—The annual meeting of the Consolidated Electric Light Company of Maine has been held and the following officers were elected: President, Leander W. Fobes; vice-president, Charles W. T. Goding; General manager and treasurer, George E. Raymond.

WATERVILLE, ME.—The Messalonskee Electric Company expects within a short time now to occupy its new place in the Moor Block. The rooms are being rapidly fitted up and when completed will make good offices. The third floor will probably be used as a work shop, and have equipment for this part of the work.

DEXTER, ME.—At the meeting of the Dexter Board of Trade the principal matter which came before the members was the report of the municipal lighting committee which for the past few weeks has been pursuing an investigation with the idea of finding out if possible if this town could be lighted with power furnished from the plant of the Sebasticook Light & Power Company at Pittsfield. According to the report of the committee consisting of Edwin Bunker, W. L. Foy and F. J. Gerry, the project was not only possible but feasible in every respect. It was learned from Charles E. Vickery of the Sebasticook Light & Power Company that the company can furnish, if needed, 300 horse-power at $25 per horse-power.

BALTIMORE, MD.—The United Railways & Electric Company is building four and a half miles of double-track extension from Sparrows Point to North Point. David E. Evans, of Baltimore, has the contract for three and a half miles and the Maryland Steel Company will build the other mile.

FREDERICK, MD.—Announcement was made January 12 to the effect that the syndicate now in control of the Frederick & Middletown Electric Railroad Company is getting ready to receive bids for the construction of an electric railway from Baltimore to Hagerstown. Both the Catoctin and South Mountains will be tunneled and this work will cost approximately $1,000,000. The building of the entire road, it is estimated, will cost $6,000,000 to $8,000,000. A large power house will be erected on the Monocacy River, and it is understood that the contract for this work will be the first to be given out.

SPRINGFIELD, MASS.—The new woodworking concern of Johnson & Hibbard will be supplied with a 20-horse-power electric motor.

WESTBORO, MASS.—A petition has been received from the South Middlesex, Hopkinton & Westboro street railway, asking for the right to carry freight in the town of Westboro.

CHESTER, MASS.—Plans are being discussed for the construction of a telephone line between Chester and Blandford. A committee has been appointed to take up the preliminaries. A. L. Lewis is chairman of the committee.

BOSTON, MASS.—The Boston & Northern and Old Colony Street Railway companies have each petitioned the Railroad Commissioners for authority to issue $200,000 bonds for the purpose of making additions and improvements.

FITCHBURG, MASS.—The laying of the conduits for the electric light wires is all completed so far as the streets are concerned and the conduit layers are working in the Nashua River, at the company's plant, where already half the river has been tunneled.

WESTFIELD, MASS.—The annual meeting of the Westfield Power Company has been held and the following officers were elected: President, M. B. Whitney; treasurer, J. B. Campbell; directors, M. B. Whitney, C. J. Little, S. B. Campbell, George Dunbar, Thomas Little, George H. Loomis, L. P. Lane; superintendent, George C. Dunbar.

GREENFIELD, MASS.—The Board of Trade directors have taken up the matter of having the streets lighted during the dark mornings of the middle of the winter from about five o'clock until daylight. A committee was appointed to present the matter to the Greenfield Electric Light & Power Company, and that company is now considering the terms for such additional lighting.

HANCOCK, MICH.—It is stated that the Michigan State Telephone Company has made an appropriation of $7,000, to be expended in improving the Iron Mountain system.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Water Power Electric Company has taken out a permit for the erection of a 1½-story brick sub-station for power purposes. The cost is estimated at $6,000.

SHELBY, MICH.—The Pere Marquette Light & Power Company will soon petition the Council for a franchise to sell electric power for lighting and other purposes. The company controls the lighting system at Pentwater and has asked the Hart Council for a franchise and contract for that village. The company is capitalized at $150,000 and owns 600 acres of land and the Pentwater lighting system. If there is not a sufficient demand for the use of the present output of 1,100 horse-power, another company will be organized to operate an electric railway between Hart and Pentwater.

PIPESTONE, MINN.—The Council is considering the establishment of a municipal lighting system here.

DULUTH, MINN.—Work will be begun soon on the construction of an electric railway from Biwabik to Hibbing, the funds having been secured by arrangement for the sale of bonds. The company, known as the Missabe Range Traction Company, has been granted a franchise for right of way. Forty miles of road will be constructed at an estimated cost of from $700,000 to $800,000. Under the terms of the franchise the road must be completed within three years.

NEW ALBANY, MISS.—The city has voted in favor of the proposed issuance of $9,000 bonds for improving the electric light plant and water works. J. O. F. Wilcox, Jackson, Miss., is the engineer in charge.

CORINTH, MISS.—The city has granted a franchise to W. J. Lamb, Simon Rubel, M. T. Bynum, Abe Rubel and C. Lennon to build and operate an electric railway in Corinth; also to operate an electric light and power plant. The same parties have also applied for charters from Mississippi and Tennessee to build electric railways to the Tennessee River.

OMAHA, NEB.—The Omaha & Council Bluffs Street Railway Company has been granted the right to cross certain roads in Sarpy County by the Commissioners of that county. This is for the new line to Bellevue, for which the company has its own right of way.

GORHAM, N. H.—The Berlin Electric Light Company is setting its poles through Gorham. The poles are in line with the poles of the Cascade Electric Light and Power Company.

NEW YORK, N. Y.—The recent increase in the capital stock of the American Light & Traction Company was made for the purpose of enabling the company to take over the properties of the Lacomb Electric Company, Denver, Colo., and the Muskegon Traction & Lighting Company, of Muskegon, Mich. The latter property is the more extensive and valuable of the two purchases, consisting of gas and electric plants and 15 miles of street railway.

WENTWORTH, N. C.—James V. Price and Samuel Ellington will construct a telephone line from Wentworth to Madison.

WINSTON-SALEM, N. C.—The Fries Manufacturing & Power Company has secured a permit for the building of a street car line here.

GREENSBORO, N. C.—The North State Telephone Company, of High Point, N. C., has secured a franchise to construct and operate a long-distance telephone system.

WEST ASHEVILLE, N. C.—There is a movement on foot here for the establishment of an electric lighting plant and the promoters are meeting with considerable encouragement.

SPENCER, N. C.—The Spencer Mountain Mills Company has had its charter amended so that it secures the right to develop water powers and operate electric lines. Its capital has been increased to $105,000.

CLEVELAND, OHIO.—The Cleveland, Ravenna & Alliance Traction Company has completed all surveys. J. W. Holcomb and C. R. Morley, of Cleveland, are back of the enterprise.

GEORGETOWN, OHIO.—An election will be held January 29 for the purpose of voting on a proposed issue of $15,000 bonds for establishing an electric lighting system in the town.

DELPHOS, OHIO.—George F. Wilson and others of this place are promoting an electric railway to extend from St. Marys to Defiance through Delphos, Spencerville and Cloverdale.

ZANESVILLE, OHIO.—The citizens of nearby towns are endeavoring to induce the new owners of the Zanesville Railway & Light Company to build a line to Duncan Falls and McConnelsville.

NEWARK, OHIO.—The Newark Independent Telephone Company is perfecting plans for the extension of its lines and making other improvements in order to provide for the demands of its rapidly increasing business.

EAST LIVERPOOL, OHIO.—The East Liverpool Traction & Light Company, which recently consolidated several traction lines and lighting plants in this vicinity, has negotiated for the issue of $3,000,000 bonds, of which $600,000 will be reserved for future additions and improvements. The company has elected officers as follows: Van Horn Ely, president; C. A. Smith, vice-president; Edward McDonald, secretary-treasurer.

PORTLAND, ORE.—The Mount Hood Electric Company, which is establishing a large power plant at the junction of the Sandy and Bull Run rivers, expects to reach Portland within six months with its wires. Only a portion of the power will be developed at first, but the plants will have an ultimate aggregate capacity of 80,000 hp. Actual construction on the plant on the Sandy will start in the spring as soon as the weather will permit.

SPRINGFIELD, OHIO.—The Springfield, Charleston, Washington C. H. & Chillicothe Traction Company has been sold at receiver's sale to George W. Baker, of Beaver, and Theodore Troupe, of Springfield, representing a Cleveland syndicate composed of W. H. Craft, E. B. Thomas and E. W. Christy. The company will be reorganized and an $800,000 bond issue floated with which it is the intention to extend the line to Washington C. H. and eventually to Chillicothe.

CHAMBERSBURG, PA.—The Borough Council has passed an ordinance granting permission to the Cumberland Valley Railroad Company to erect a power house on Kennedy Street. The probable cost of the plant is estimated at $100,000.

ALLENTOWN, PA.—Application has been made by the Schuylkill Valley Traction Company to lay tracks in West King and Berks Streets, Pottstown, in order to extend its lines from Pottstown to Birdsboro. At the latter place the road will connect with the company's tracks running to Reading. The building of the link will make a complete electric railway between the latter place and Philadelphia.

PITTSBURG, PA.—Street railway charters have been granted for the construction of electric lines from Monongahela River towns to Wellsburg, on the Ohio River. The charters are for the Coal Center Electric Company, West Middletown Electric Railway Company, Washington & Brownsville Street Railway, and the Independence Street Railway Company. The nominal capital of each company is $12,000. D. B. Neagley, Charles H. Robensteen and William T. Pierce, of Pittsburg; W. H. Armstrong and H. M. McClure, of Washington, Pa., are the incorporators.

YORK, PA.—In the region of McCall's Ferry, where the work preliminary to that of constructing an immense power plant and dam by the McCall's Ferry Water & Power Company is in progress, flowing ice in the river recently interfered with the engineers and workmen in crossing and recrossing the stream. To overcome the delays an engineering trick was resorted to and the broad river was practically bridged within a space of 24 hours. A 1-inch cable was taken from the company's equipment for the building of the dam and was uncoiled. The cable was dragged across the river and made fast to a large tree on either side of the river. It was then stretched by the united efforts of 200 men at either end and 50 horses. A basket was then rigged to the cable with a roller attachment for its operation. In this basket car swinging high above the surface of the river the engineers and workmen make their transits across the stream.

EDGEFIELD, S. C.—The city is considering the installation of water works and an electric light plant. J. C. Sheppard is chairman of the committee.

ANDERSON, S. C.—Practically all of the new issue of stock of the Anderson Traction Company, amounting to $220,000, has been subscribed and the 10-mile line to Belton will in all probability be built.

KNOXVILLE, TENN.—The Knoxville Railway & Light Company is now preparing for the extension of the Broadway Line to Fountain City.

MEMPHIS, TENN.—The Memphis Street Railway Company is contemplating numerous improvements in its system, including the building of new lines and the extension of its present ones. For this purpose it has recently increased its capital stock from $500,000 to $5,000,000.

MUSSEL SHOALS, TENN.—It is expected that a bill will be introduced in Congress granting a large Philadelphia electric company a franchise to develop the power of the Mussel Shoals on the Tennessee River. The engineers of the company have reported that there is enough power at the Shoals to supply a large number of cities within a considerable distance of the power plant.

LUFKIN, TEX.—McCarthy, Starnes & Company, of Lufkin, will install an electric light and power plant in that place.

BEAUMONT, TEX.—Emmett Landry is promoting the organization of a new electric light and power plant for Beaumont.

DALLAS, TEX.—It is announced that everything is in readiness for the early construction of the interurban electric railway between Dallas and Mesquite. A. C. Nafus, of Mesquite, is interested in the project.

EL PASO, TEX.—Plans for the extension of the electric railway system of the El Paso Electric Railway Company from El Paso to East El Paso are said to have been approved by Stone & Webster, of Boston, the owners of the property.

HOUSTON, TEX.—The Houston Lighting & Power Company, which has been reorganized with a capital stock of $1,000,000, has obtained its charter from the secretary of state. The incorporators of the company are A. H. Ford, of New York; Henry P. Dart, Sr., Henry P. Dart, Jr., E. A. Neugass, Isidore Newman and sons, all of New Orleans; Norman Alexander, of New York, and J. W. Terry, of Galveston. W. H. Chapman remains with the new company as general manager. Additions and improvements will be made.

IRON GATE, VA.—An electric lighting system will probably be established here. Address the Mayor for further information.

BLUEFIELD, W. VA.—William E. Fowler, of Graham, has applied for a charter to erect an electric light plant here. There will be water works and an ice plant run in connection with the lighting plant.

VIENNA, VA.—Reports state that the Washington, Arlington & Falls Church Railway Company is considering the erection of an electric power plant at Vienna. F. B. Hubbell is vice-president and general manager, 3528 M Street, Washington, D. C.

SHENANDOAH, VA.—The Town Council has awarded a contract to George C. Morgan, of Chicago, for the installation of water works and an electric lighting system. The power will be obtained from the Shenandoah River, near the town. The cost of the enterprise is estimated at $25,000.

LURAY, VA.—The Shenandoah River Power & Light Company proposes to develop the water power of the Shenandoah River two miles from Luray and transmit electric power to the town for lighting and other purposes. A dam is being constructed across the river and from 600 to 1,200 horse-power will be developed.

KENOSHA, WIS.—The Kenosha Electric Railway Company has sent a petition to the City Council asking that the company be granted a franchise to make extensions to its lines in the city.

MILWAUKEE, WIS.—Franchises for two electric railways have been asked of the Common Council, one by the Milwaukee Northern Railroad Company to enter the city from the North, and the other by the Chicago & Milwaukee Electric Railway Company, coming from the south. The Milwaukee-Northern Company proposes to make its line a part of an interurban system which eventually will run from Fond du Lac to Sheboygan, thence down the shore to Kenosha, where it will connect with the line to Chicago. Franchises are also being asked of the Councils of Port Washington, Sheboygan, Fond du Lac and Cedarburg.

CULIACAN, MEX.—The Compania Minera de Penuco will install an electric light and power plant in the Concordia district, State of Sinaloa.

SAN CRISTOBAL, MEX.—A company of local capitalists has been organized in San Cristobal for the purpose of installing an electric light and power plant. The same company will build an electric street railway system in the town.

DURANGO, MEX.—James H. Lesdon, an electrical engineer, has been investigating the situation here on behalf of an American syndicate, said to be of Boston, with the view of installing a new electric light and power plant for the city of Durango. The same parties contemplate constructing an electric street railway system in Durango.

OWEN SOUND, ONT.—The promoters of the Huron & Ontario Electric Railway Company state that the construction of the road will be begun in the spring. The company's offices are in Toronto.

ST. CATHARINES, ONT.—Arrangements are now being concluded for the construction and erection of two poles of reinforced concrete, 150 feet in height, to carry transmission wires over the old Welland Canal for the Lincoln Electric Light & Power Company. There are nearly 100 of these concrete poles erected along the Welland Canal electrical transmission line.

COMITAN, MEX.—An electric light and power plant is to be installed in Comitan by a company of local capitalists.

MAZATLAN, MEX.—The installation of an hydro-electric plant at the falls of the Piaxtle River in the State of Sinaloa is to be made by the Compania Minera Guadalupe de los Reyes, which owns several mines in the Cosala district. The plant will have a capacity of 5,000 horse-power and will cost about $800,000. The plans for the plant were prepared by Robert McF. Doble, of San Francisco.

SAHUARIPA, MEX.—Miguel A. Lopez, an attorney of the City of Mexico, has obtained a concession from the federal government on behalf of a syndicate of capitalists for the erection of a large electric power plant on the Yaui River, near Sahuaripa. The free importation of the material and machinery necessary for the construction of the plant is granted. It is stated that the proposed plant is to provide power for mines and industries of the Sahuaripa district.

PARRAL, MEX.—The concession which L. Iwansky, of Parral, and associates obtained from the federal government of Mexico several months ago for the installation of a large electric power plant in the Parral district, has been taken over by a syndicate of Pittsburg, Pa., men and a company is now being organized. This project was referred to in Electrical World and Engineer Dec. 9, 1905. In addition to providing power for the Parral district the company has planned to build transmission lines to the Inde, Santa Barbara and Guanacevi mining districts.

New Incorporations.

LOS ANGELES, CAL.—The Mutual Electric Company has recently been incorporated. Its directors are F. J. Steele, J. O. Horton, J. E. Moore, J. T. Boyd and A. W. Billington, all of this city.

DALZELL, ILL.—S. H. Brakel has been granted a franchise to construct and operate a telephone system in Dalzell.

CHILLICOTHE, ILL.—The Chillicothe Water, Light & Power Company has taken out incorporation papers. The incorporators are W. H. Foster, Frank H. Earl and Charles H. Kingsbury. The capital is $75,000.

HOOPESTON, ILL.—The Hoopeston Gas & Electric Company has filed articles of incorporation, with a capital named at $200,000. The incorporators are Frederick A. Platt, William L. Jenks and H. L. Handley.

TERRE HAUTE, IND.—The Indiana Rapid Transit Company has filed articles of incorporation to build a traction line from Terre Haute to South Bend. P. M. Dunn and A. M. Weeden are among the incorporators.

ELKHART, IND.—The Elkhart Independent Telephone Company has been incorporated with a capital stock of $1,250 to install and operate a telephone system. G. G. Taylor, A. W. James, J. C. Taylor are the incorporators.

ELIZABETHTOWN, ILL.—The Hardin County Telephone Company, of this place, has filed articles of incorporation, with a capital stock of $6,000. Among the incorporators are T. D. White and Daniel W. Whitenberg.

ROSEBORO, N. C.—The Roseboro-Fayetteville Telephone Company has been granted a charter. The company proposes to construct a line from Roseboro to Fayetteville and branches for a number of farmers and others in that section.

CARTHAGE, N. C.—The Carthage Telegraph Company has filed its charter and will construct and operate a telegraph line between Cameron, Hallison and Carthage. W. C. Petty, J. C. Petty and W. C. Petty, Jr., are the promoters of the project.

UNADILLA, NEB.—Articles of incorporation of the Unadilla Telephone Company have been filed with the County Clerk. The company will build an exchange of fifty telephones, which will connect with the farms in that neighborhood, the central office being in this city.

LAKE BENTON, MINN.—The Lincoln County Telephone Company has been incorporated with a $50,000 capital.

HURDLE MILLS, N. C.—The North Carolina Telephone Company has been chartered, with a capital of $100,000. The incorporators are J. S. Schley and others.

KALAMAZOO, MICH.—The Kalamazoo & Eastern Railway Company has been incorporated under the laws of Michigan for the purpose of building an electric railway from Kalamazoo to Paw Paw and Marceline. The capital stock of the company is $250,000, and F. F. Bennett, of this city, is one of the principal incorporators.

DAVENPORT, OKLA.—C. R., W. R. and C. A. Ridley have filed articles of incorporation for the Ridley Telephone Company, having a capital stock of $5,000.

HENNESSEY, OKLA.—The Electric Light & Power Company has been incorporated, with a capital of $15,000, by C. C. Smith, Fred Ehler and others.

DUNKIRK, OHIO.—The Manufacturers' Light & Power Company has been recently incorporated by A. O. Fisher, R. R. Ramsey and others. The company is capitalized at $50,000.

SAXONBURG, PA.—The Saxonburg Heat & Light Company, with a capital of $5000, has been incorporated by John B. Patterson, of Freeport; W. H. Knock, of this city, and others.

WILKESBARRE, PA.—The Hazleton, Weatherly & Mauch Chunk Electric Railway has been incorporated, with a capital of $200,000, for the purpose of reviving the project to build an electric railway between Hazleton and Mauch Chunk. Frank Larned is president of the company, and other Wilkesbarre capitalists interested in the undertaking are J. K. Weitzenkorn, Christian Walter and A. H. Bloom.

SIOUX FALLS, S. D.—A company has been organized and incorporated by Sioux Falls business men, under the name of the Sioux Falls Interurban Electric Railroad Company. Among those behind the project are Dr. R. F. Brown, Michael Gerin and J. A. Gross. Dr. Brown is president of the company and George A. Pettigrew secretary.

NASHVILLE, TENN.—The Farmers' & Merchants' Telephone Company, of Frederick County, Va., has been incorporated by J. H. Funkhouser, P. H. Funkhouser and J. S. Haldeman.

CESTOS, TEX.—Articles of incorporation have been filed by E. C. Hoyt, J. W. Kerns and H. A. Seaton, composing the Independent Telephone Company, of this city. The company, having a capital of $25,000, will establish a telephone system here.

KNOXVILLE, TENN.—The Knoxville & Maryville Electric Railway Company has been incorporated by W. S. Nash, Robert Vestar, Joseph P. Gant, W. T. Parham, J. C. Sterchi, J. Burger and Haywood Garrick. The company is capitalized at $100,000.

BRENHAM, TEX.—The Brenham & Washington Telephone Company has been chartered here for the purpose of constructing a telephone line from Brenham to Washington. John M. Mathis, E. P. Curry and D. C. Giddings are the incorporators.

INWOOD, W. VA.—The Inwood Rural Telephone Company has been organized to construct a telephone system.

SHAMROCK, TEX.—J. E. Walker, Barnett Blossom and Rea Blossom have incorporated the Walker Telephone Company, having a capital of $10,000.

BLACKSVILLE, W. VA.—The Greene County Telephone Company has been incorporated to construct and operate telephone lines in Marion and Monongalia counties. The company is capitalized at $100,000 and is composed of Edward McSweeney, Thomas B. Lee, Edward Barrett and Edward T. Galway.

OSCEOLA, WIS.—The Osceola Farmers' Mutual Telephone Company has been organized. The capital stock is $25,000. John Getchel and S. A. Francis are among the directors.

LOYAL, WIS.—The York Center Telephone Company has filed articles of incorporation with a capital of $10,000. Among the incorporators are W. J. Rush and C. H. Brown.

New Industrial Companies.

THE J. W. SMITH ELECTRIC COMPANY, of Norfolk, Va., has filed articles of incorporation with a capital stock of $10,000. The company will engage in a general electrical construction business.

THE MENOMINEE ELECTRICAL MANUFACTURING COMPANY, of Menominee, Mich., is preparing plans for the erection of a new plant to be constructed of brick and stone. The new building will be 62 ft. by 335 ft.

THE GEORGIA MANUFACTURING & PUBLIC WORKS COMPANY has been organized at Marietta, Ga., to take charge of the Marietta Electric Company and other utilities. The new concern has a capital of $600,000.

THE W. J. BARR ELECTRIC COMPANY, Cleveland, Ohio, has filed articles of incorporation, with a capital stock of $200,000. W. J. Barr, J. W. Burrell, C. M. Little, D. P. Foster and William E. Patterson are the incorporators.

THE ELECTRIC CABLE COMPANY, Bridgeport, Conn., has filed its articles of incorporation with the Town Clerk, stating its capital stock to be $5,000. The new company will conduct a general electrical business. Edwin W. Moore is one of the incorporators.

THE NEW YORK-NEW ORLEANS ELECTRIC COMPANY, New Orleans, La., has been chartered with a capital of $1,000,000 to engage in a general electrical business. The officers are Maurice J. Hart, president; Hewes T. Gurley, vice-president, and Robert O. Randle, secretary and treasurer.

THE BROWN-SPEAR-SLOANE COMPANY, San Francisco, Cal., has been incorporated with a capital stock of $65,000, by F. L. Brown, L. E. Spear, C. F. Sloane, H. F. Wilson and Victor Enginger. The company succeeds to the business of the Charles F. Sloane Company and will handle a good line of electrical supplies.

THE AMERICAN AUTOMATIC TELEPHONE COMPANY, of Rochester, N. Y., has been incorporated for the purpose of manufacturing electrical and mechanical apparatus. The company has a capital of $1,500,000, and was incorporated by Joseph E. Webster, J. William Lattig, John Raines, Alvaro L. Thompson, Henry H. Stebbins, Jr., and George R. Raines.

Legal.

ECKERT BUSTS.—A verdict for $4,000 was awarded last week to Grant Wright, as assignee to Frederick E. Triebel, the sculptor, by a jury in Part I. of the Supreme Court, Brooklyn, N. Y., against Clendenin Eckert, president of the International Bank Note Company. The money was asked for the execution of two bronze busts of Gen. Thomas T. Eckert, father of the defendant, and formerly president of the Western Union Telegraph Company. It was urged by Mr. Eckert that a bust of his father was made by the sculptor for $600, and that he afterward made the two busts as a speculation. He denied having ordered them. Mr. Triebel testified that he had made the first bust for $600 on the promise of the defendant to get orders for him. Eckert failed to do so, he said, and Triebel demanded the full price for the busts. Several experts were called to testify to the value of the busts, among them Sculptor Nichaus and Wilson McDonald. The busts were exhibited in the court room.

A FRANCHISE ATTACKED.—Attorney General Mayer of New York State announced last week that he had received a petition from Abraham Sartorius, a citizen of New York City, to begin an action on behalf of the State to annul the corporate rights and franchises of the New York Electric Lines Company and for an annulment of its charter to do a general telephone business in this city. Mr. Sartorius gives three reasons for his petition. One is that the New York Electric Lines Company has suspended its ordinary and lawful business for more than one year; the second that the company has forfeited its privileges and franchises by a failure to exercise its powers; the third that the company did not begin the transaction of its business within two years of the date of incorporation. The franchise granted to the New York Electric Lines Company recently passed into the control of the Great Eastern Telephone Company, which has announced that it intends to use it to begin a general "independent" telephone business in this city.

Obituary.

MR. GEORGE H. THAYER, for thirty years superintendent of the Chicago and Northwestern Railway division of the Western Union Telegraph Company, died a few days ago at his residence in Norwood Park. Mr. Thayer was born at Weathersfield, Vt., on Jan. 8, 1843. He was connected with the Western Union Company forty-five years.

MR. C. H. HINES.—We report with deep regret the sudden death from fever at Puebla, Mexico, of Mr. C. H. Hines, who was on his way to New York suffering from the effects of tropical malaria and had stopped en route to consult a doctor. A biographical sketch was given in our issue of October 14. He was born in Buffalo, N. Y., March 6, 1865. While following the medical course in the New York Medical College, he became interested in electricity and in 1884 he entered as a student the works of the Daft Electric Company at Greenville, N. J., where, under the personal supervision of Mr. Leo Daft, he assisted in the first commercial railway work in this country, and in equipping the cars Volta, Ampere and Ben Franklin, the latter being used in the Daft pioneer experiments on the New York elevated. From 1886 to 1891 he was in the employ of Mr. Augustus Noll and the Edison Electric Illuminating Company of New York. In 1891 he went to Salvador, Central America, where he designed and erected steam and hydraulic alternating-current plants in two cities, these being among the first electric plants installed in those countries. In 1893 he installed the city plant at Tampico, Mexico, and also in the same year that at Newton, N. J. In 1896 he became superintendent of construction for the Andrews-Ryan Company of Boston, and installed two central exchanges, at Hampton, Va., and Haverhill, Mass. In 1898 and 1899 Mr. Hines was engaged in cable work at Santiago and Manila, and in 1901, while a constructing engineer for the General Electric Company in the foreign department, erected large plants at Charleston, S. C., and Banes, Cuba. In August, 1901, he was appointed superintendent of the electrical department of the Lorain Steel Company, remaining with that company until February, 1893, when he was appointed electrical engineer of the Canadian Pacific Railroad. While occupying this latter position he designed large plants at Montreal and Fort Williams, aggregating 10,000 horse-power, and had charge of the electrical work of 8,000 miles of railroad and two steamship lines. This position he resigned to accept employment by the Erie Railroad Company as consulting engineer and to prepare a report on equipping the Erie shops electrically. Upon the expiration of this duty Mr. Hines went to the United States of Colombia, where he reconstructed the Medelin electrical generating plant. While there he became interested in gold mining and upon his return to this country was sent back as superintendent of two large gold mining properties. Mr. Hines was an inventor in several departments of electrical engineering and has been granted patents among others on a brush holder, magazine arc lamp, reduction furnace, controller, brake, system of car ventilation and method of winding coils. He contributed a number of articles to the technical press, dealing principally with electric power distribution in shops. He was a member of the American Institute of Electrical Engineers and other societies. He leaves a widow and family. Unfortunately, Mr. Hines had no life insurance, and his illness had exhausted his savings so that the widow is left entirely destitute. Under these circumstances his friends may be glad to learn the address of Mrs. Josephine Hines, viz 179 Decatur Street, Brooklyn, N. Y., where she will be during the month.

Educational.

LECTURES AT STEVENS.—On Jan. 8 two special lectures were given to the senior class of the Stevens Institute of Technology, Hoboken, N. J. The subject of the first was "Patent Law," delivered by Mr. Wm. R. Baird. This is the first of three lectures to be given on this subject. It was full of information and will be of use to students of an inventive turn. The other lecture was given by Mr. J. W. Lieb, Jr., associate general manager of the New York Edison Company. The subject was "Generation and Distribution of Electricity in New York City." His "bird's eye view" of the conditions of electric lighting in New York City was very comprehensive, and the address was of great value to those who heard it.

LIBRARY OF TECHNOLOGY.—The International Text-Book Company, Scranton, Pa., has issued a 40-page descriptive catalogue dealing with its "Library of Technology," which has been prepared by the Faculty of the International Correspondence Schools, in conjunction with many of the best-known engineers of America. The books treat of all classes of engineering. The volumes on elementary electricity and magnetism, dynamo design, alternating currents and electric transmission, electric lighting, electric power stations and electric railways are exceedingly practical treatises on these subjects. It is stated that the material in each book has been gone over carefully by some practicing engineer familiar with the particular subject, so that possible inaccuracies and misstatements have been eliminated.

WORCESTER POLYTECHNIC INSTITUTE.—The Worcester Polytechnic Institute has just published its thirty-sixth annual catalogue, the information contained giving evidence of gratifying progress along the lines of technical education. In glancing over the list of alumni, one is particularly impressed by the very large proportion of the total number of graduates who are at present engaged in work for which they were fitted by their Institute courses. By far the greater number of these men are engaged either in actual engineering or very closely allied work. The catalogue shows a total registration of 388 against 324 last year and 272 two years ago. A corresponding increase is noted in the number of candidates for the advanced degrees of Master of Science and Doctor of Science and the professional degrees of Mechanical, Civil, Electrical and Chemical Engineer. The addition of courses in electrical engineering having to do especially with electric railway and power plant engineering is also noted, these courses being under the direction of Professor A. S. Richey, the only addition to the faculty, whose title is Assistant Professor of Electric Railway Engineering.

Personal.

ROSSITER, MacGOVERN & CO., of New York, have announced their entrance into the engineering and contracting field as engineers and contractors for all classes of work, with steam and electric railways and electric power plants as specialties. Mr. J. C. Brackenridge, president of the company, is well known in the traction field through his connection with the Brooklyn Rapid Transit Company, first as chief engineer and later as general manager. His association with the Brooklyn Rapid Transit Company extended over a period of ten years, during which all of the more recent power stations of the company were built, the greater part of the elevated railway system electrified and the operation of the

MR. J. C. BRACKENRIDGE.

MR. FRANK MACGOVERN.

cars extended over the present Brooklyn Bridge, all of which was accomplished under his immediate supervision. Mr. Brackenridge resigned from the Brooklyn Rapid Transit Company two years ago to accept the position of Commissioner of Public Works, of Brooklyn, which office he occupied until the first of the current year. Mr. Frank MacGovern, under whose direction the present success of the company has been attained, will continue as vice-president and general manager and Mr. James R. Floyd, Jr., as treasurer. Mr. Clinton L. Rossiter, who was formerly president, has resigned from that office but remains a member of the executive committee and is still actively connected with the company.

DR. H. B. ROCKWELL has resigned as general superintendent of the Mobile Light & Railroad Company, of Mobile, Ala.

PROF. F. B. CROCKER, of Columbia University, has made a trip to Cuba this winter for recreation, and has just returned from Havana.

MR. F. D. WHARTON, lately with the Wilkesbarre, Pa., Gas & Electric Company, has been appointed as superintendent of the Dauphin County, Pa., Gas Company.

MR. A. M. MATTICE has resigned from the Allis-Chalmers Co. and is removing from Milwaukee to New York, where he will take up important engineering work.

MR. JOHN MESSLER, who was formerly with the Quincy, Ill., Gas, Electric & Heating Company, has joined the firm of Miller & Butler, electrical engineers and supply dealers, in that city.

MR. F. SARGENT, the consulting electrical and mechanical engineer of Chicago, sailed last week for England, accompanied by his wife. He will spend some little time on the other side.

MR. ALLEN RIPLEY FOOTE, for lack of support, has been compelled to suspend the issuance of his week paper, "Public Policy," which aimed to establish better relations between corporations, the public and labor.

MR. J. J. GORMAN has resigned as an officer of the Manhattan Electrical Supply Company, New York. We are informed that he still retains his interests in the company, but will no longer be actively engaged in conducting the business.

MR. EDWARD TAYLOR, formerly engineer of tests of the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., has become sales agent for the H. W. Johns-Manville Company, of New York, for Milwaukee and the surrounding territory.

MR. WILLIAM S. EARLE, for the past four years connected with the office of the City Engineer, of Worcester, Mass., has resigned to accept a position under Mr. Frederick A. Huntress, general manager of the Rio Janeiro Street Railway & Power Company.

MR. C. E MITCHELL, who has held the position of assistant to the president of the Western Electric Co., Chicago, for sometime past, is

resigning to accept the position of assistant to Mr. Oakley Thorne, president of the Trust Company of America, New York.

MR. WALTER C. KERR, the well-known president of Westinghouse, Church, Kerr & Co., is the subject of an illustrated biographical sketch in the *Sibley Journal of Engineering* for December, just issued. Mr. Kerr is one of the trustees of Cornell University, from which he graduated in the class of 1879, becoming instructor and assistant professor.

MR. HERBERT E. RYDER, for the past 16 years connected with the Marlboro, Mass., Electric Company, has been promoted from chief electrician to superintendent. He began as a lamp trimmer and has worked his way up steadily through all the grades. He is popular with the public. The service of the company will now be put on a 24-hour basis.

MR. H. E. GAWTRY, for so many years president of the Consolidated Gas Company, of New York City, which operates also the electric lighting systems, has gone to Southern France and Egypt in search of health this winter. It will be remembered that he resigned the presidency some months ago, but assumed the chairmanship of the executive committee.

MR. JOHN A. BRITTON, who has been the active manager of the California Gas & Electric Corporation, with the title of vice-president and general manager, was elected to the presidency of the San Francisco Gas & Electric Company upon the recent reorganization of that corporation. Mr. Britton is also to become president of the Pacific Gas & Electric Company.

MR. H. H. SUPLEE.—In the current January-March *Forum*, Mr. Henry Harrison Suplee's record of "Applied Science" gives numerous specific examples tending to show that a characteristic feature of modern engineering is the extent to which material means are modified to suit the desired ends instead of the reverse procedure, which used to be the case.

MR. HARRY M. BEARDSLEY, secretary and treasurer of the Elmira Water, Light & Railroad Company, of Elmira, N. Y., has been appointed receiver of the Elmira & Seneca Lake Railroad Company in place of D. A. Hegarty, of New York City. The line will be operated by the Elmira Traction Company, and Mr. Beardsley, who has had a large share in the negotiations which have been on for sometime, is well qualified by virtue of his intimate acquaintance with the affairs of the line to administer the receivership.

MR. IRVING MOULTROUP, of the Boston Edison Company, representing the steam turbine committee of the National Electric Light Association, has sailed to Europe to investigate turbines. It is the intention of the committee this year to report on the progress of the steam turbine here and abroad, also to include in its work an investigation of gas turbines.

MR. HENRY T. SCOTT.—It is announced from San Francisco that Mr. Henry T. Scott has been elected president of the Pacific States' Telephone & Telegraph Company at a salary of $25,000 a year. Since the death of John I. Sabin there has been no president of the corporation. Mr. Scott was formerly president of the Union Iron Works, which built the famous battleship "Oregon."

MR. BENSON BIDWELL, whose name became well known in the early trolley days, has been advertising in the St. Louis papers the chances of an everlasting fortune in his "cold motor" and his "water electric generator." The stock is offered at a generous reduction, and the returns are to be illimitable. The devices are not explained, but are set forth on a background of non-luminous rhetoric.

MR. A. P. SEYMOUR.—We learn that owing to ill health, Mr. A. P. Seymour, vice-president and treasurer of Pass & Seymour, Inc., Solvay, N. Y., has retired from business and will hereafter make his home in Southern California. Mr. Seymour's stock has been acquired by the interests that have been identified with the company since its inception 15 years ago. The company has indeed done splendid work in raising the standard of porcelain insulation for electricity and the departure of Mr. Seymour from the field of active work will be deeply regretted by many old friends.

Mr. P. N. NUNN, so well known in connection with power transmission enterprises in the west and more lately in connection with work at Niagara, has just issued a handsome pamphlet entitled "The Development of the Ontario Power Company." It is large octavo, well illustrated and gives an excellent description of the engineering features of the plant, as well as of the reasons for adopting certain types of apparatus. Mr. Nann, who is deserving of great credit for his share in this undertaking, is careful to name several of the engineers associated with him, viz., Messrs. O. B. Suhr, V. G. Converse, C. H. Mitchell, J. H. Bailey and J. R. Harsch.

MR. JOHN LORENZ, who has for the past three years been the general manager of the combined railway, light and gas properties of the Jackson Electric Railway, Light & Power Company at Jackson, Miss., is retiring from the management of the said property to become president of the Jackson, Clinton & Western Traction Company, which company proposes to build an interurban line from Jackson, Miss., to Clinton, Miss., a distance of 10 miles. The line is to be built on private right of way, and will carry express and baggage. Mr. Lorenz has had the active control and management of this class of properties for 16 years and has proven himself a very competent manager and organizer.

MR. B. E. SUNNY, manager of the Chicago district for the General Electric Company, has been taking a prominent part in practical philanthropic movements for several years past and was honored last week by appointment to a place on the board of trustees of the State Hospital for the Insane at Kankakee, Ill. This is the beginning of a movement by Governor Dineen of Illinois to place the management of Illinois state institutions on a non-partisan basis and appoint men of business standing and qualifications to these places. Mr. Sunny's appointment is therefore gratifying both to his immediate friends and to the advocates of good government the state over.

MR. JOHN LUNDIE, the well known and highly respected electrical engineer, has been made the subject of attack by Secretary of War Taft, because of statements made on the Panama Canal by Mr. P. Bigelow in *The Independent*. The drift of the attack on Mr. Lundie's reputation may be inferred from the following passage: "Just as Mr. Wallace left the Isthmus he appointed this same Mr. John Lundie as consulting engineer, at a salary of $500 per month, to make a report of oils and fuels on the Isthmus, subject to the approval of the chairman of the Commission. Mr. Wallace's action was disapproved by Mr. Shonts, and Mr. Lundie was not appointed. The writer's willingness to draw his facts from such a fountain of manifest malice, injured vanity, and disappointed ambition, completely refutes his good faith in asserting his wish to find and state the truth."

HON. C. D. WRIGHT.—Hon Carroll D. Wright, former head of the Department of Labor, has been decorated with the Order of SS. Maurizio e Lazzaro, conferred upon him by the King of Italy in recognition of his work as a political economist. The presentation was made by Count Aldrovandi, the Italian Vice Consul. The order of S. Maurizio is among the oldest orders of chivalry in Europe. It was founded in 1434 by Amedeus VIII, restored in 1532 by Emanuel Filibert, and afterward consolidated with the Order of S. Lazzaro, which is so ancient there is no record of its foundation. The decoration carries with it the right to wear the uniform of the order. Under the Court regulation, the Chevaliers of the order are classified with the Chevaliers of any other order as to their precedence at Court functions. The decoration itself is a large Maltese cross in white enamel and gold, with a wreath of laurel in the centre.

Trade Publications.

THE WORCESTER ELECTRIC MFG. CO. has sent out a very handsome calendar for 1906, and incidentally calls attention to its line of knife switches, switchboards and panel boards.

ALTERNATORS.—The Allis-Chalmers Company, Cincinnati, Ohio, has issued bulletin No. 1048, giving a well-prepared description of Bullock alternating-current generators of both the engine and fly-wheel types.

MOTOR DRIVE.—Circular No. 18 of the Electro-Dynamic Company, Bayonne, N. J., illustrates some interesting motor drives in which the "Inter-pole" motor shows its advantageous variable-speed, non-sparking characteristics.

GLOBE VALVES.—A bulletin recently received from Jenkins Bros., 71 John St., New York, gives an illustrated description and an itemized price list of extra heavy brass and iron Globe valves for pressures in excess of 150 pounds per square inch.

ENGINE-STOPS.—The Consolidated Engine-Stop Company, 100 Broadway, N. Y., has issued an attractive circular on the Monarch engine-stop and speed-limit system which serves to call attention to the fact that the Monarch system insures against death, accident, bursting fly-wheels, monetary losses, etc.

TELEPHONES.—The Kellogg Switchboard and Supply Company, Chicago, Ill., has issued a neat little calendar, in connection with which it calls attention to the fact that it manufactures telephones of every description for either magneto or common battery systems, a few of which are illustrated in the pamphlet containing the calendar.

ELECTRIC FLASHLIGHT NOVELTIES.—A well-illustrated, 48-page catalogue recently received from Stanley & Patterson, 40 Cortlandt St., New York, is devoted to "Matchless" electric flashlight novelties, including pocket lamps, electric candles, illuminated clock dials, gas lighters and surgeons' and photographers' electric lighting outfits.

FUSIBLE HANGER BOARDS.—Bulletin No. 28 of the H. T. Paiste Company, Philadelphia, Pa., deals with a new line of fusible hanger boards for multiple arc lamps, which comprise the necessary types for three distinct styles of wiring, namely, cleat, concealed and molding. Brief descriptions are also given of panelette and taplets and similar wiring specialties.

ELECTRIC HOISTING MACHINERY.—Bulletin No. 62, recently issued by the Crocker-Wheeler Company, Ampere, N. J., contains what can be characterized as a well-prepared and adequately illustrated article on electric hoisting machinery. The illustrations show the application of Crocker-Wheeler motors to all kinds of hoisting machines as built by several manufacturers.

LIGHTING SUPPLIES.—Supply catalogue No. 7,594, of the General Electric Company, Schenectady, N. Y., gives a price-list of parts of edgewise-wound, parallel-rod, 220-volt direct-current enclosed arc lamps, forms 5 and 4, without cut-out or cut-out resistance. Flyer No. 2,169 of the same company deals with double push-button flush pocket switches, while flyer No. 2,170 treats of "Competition" knife switches.

INSULATED WIRES.—The Indiana Rubber & Insulated Wire Company, Jonesboro, Ind., has issued a booklet devoted to "Paranite" and "Peerless" rubber-covered wires and cables. The booklet contains a photographic re-

production of the National Electrical Code and numerous tables of weights and measurements and useful information regarding metals, wiring tables, etc.

TELEPHONE EXCHANGES.—Bulletin No. 14 of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is a handsome loose-leaf catalogue dealing with private branch telephone exchanges. The bulletin is of practical value to the experienced telephone man, containing information concerning every detail which enters into the construction of these exchanges. The bulletin contains 42 pages and is illustrated throughout.

INDUCTION MOTORS.—Circular No. 200 of the Commercial Electric Company, Indianapolis, Ind., gives a brief description of a line of motors which this company is now placing on the market. It is stated that advantage has been taken of the experience of the various European manufacturers by retaining the services of the eminent engineer, Mr. H. M. Hobart, of London, who has for years been engaged in designing corresponding machines for various continental factories.

SPRINGS—The Wallace Barnes Co., Bristol, Conn., manufacturer of small springs of every description, in an artistically-designed and executed pamphlet shows illustrations of a great variety of springs manufactured by this concern. The cuts, which are displayed in an artistic manner in the margins of the pages, present views of springs of many forms, including the extension and compression varieties, motor springs, automobile-engine springs, etc. The company also makes a wide variety of hardened and tempered washers.

A BRITISH CALENDAR.—The business enterprise of our English cousins in the field of advertising is indicated by the New Year's tokens which have recently found their way to this side of the Atlantic. Prominent among these is the elaborate blotting pad of the Electrical Power Storage Company, Ltd., 4 Great Winchester St., London, E. C., which holds a desk blotter flanked by a most useful scribbling diary containing space for every day in the year, interleaved throughout with blotting paper, and surmounted by 12 strips containing the days of each month in bold type, fastened at the ends by brass clamps, and easily detachable.

THE CLEVELAND RUBBER WORKS, of the Mechanical Rubber Co., at Cleveland, O., issues a very neat folder showing the seven sizes of its soft rubber rings for protecting the bases of sign and display lamps exposed to the weather. Every incandescent electric sign and display lamp thus exposed to the weather should be protected at the base in this manner. When lamps are so equipped, there is not much likelihood of short circuits, which means less possibility of fires and longer life for the lamps. The expense of using the rings amounts to practically nothing, when the service rendered is considered. There are seven sizes of "Cleveland" rings being made for the purpose, which permits of their use on every style of lamp.

FANS, BLOWERS AND EXHAUSTERS for heating and ventilating, mechanical draft and other purposes are described in a booklet issued by the Green Fuel Economizer Co., of Matteawan, N. Y. This company has for many years installed fans and exhausters for mechanical draft in connection with the Green fuel economizer and has long been aware that important improvements could be introduced in air-moving apparatus. The Green Fuel Economizer Company does not contract for the engineering of plants, nor for the installation of heating and ventilating plants in competition with the heating and ventilating contractors. It has recently added large shops to its plant at Matteawan to handle this branch of the business.

RAIL BONDS.—The John A. Roebling's Sons Company, Trenton, N. J., has issued a neat catalogue dealing with soldered rail bonds. The bond of this type is made of a flat strip of copper wound to the required dimensions and shaped in a press. The strip is tinned to prevent corrosion, and the method of manufacture produces a one-piece bond of great flexibility. The solder pocket is a distinct feature of the Roebling bond. A socket is formed on the face of the bond, about one-sixty-fourth inch deep and somewhat smaller than the part of the bond in contact with the rail. The solder is run into the pocket by heating the bond to the proper temperature, and it consequently "sweats" to the surface.

QUEEN & CO., 1010 Chestnut Street, Philadelphia, have issued a new catalogue 1105, describing their electrical testing instruments and other scientific apparatus. The line is most complete and the Queen shops and laboratories in Philadelphia have now been concentrated in one building to the immediate proximity of which they have recently moved their wholesale departments, so that they are better prepared than ever to handle orders with promptness and precision. Further information than the catalogue supplies, as to any of the instruments, will be furnished on request. The Queen Company are constantly designing and producing new apparatus, and invites correspondence as to any such appliances in the scientific instrument line.

THE WHEELS OF VICTORY.—As specially commemorative of the victory which the Abner Doble Company, of San Francisco, won at the Louisiana Purchase Exposition, it is presenting to its friends an allegorical design in photogravure typifying "Victory." This is a photographic reproduction from a bronze by M. Debut, the original of which is in the private office of Mr. William A. Doble, president of the Abner Doble Company. The water wheel upon which "Victory" is riding is a photograph, reproduced to the correct scale, of the runner of the company's wheel exhibited at St. Louis. Appreciating the fact that the photogravure has some artistic merit and realizing that a few friends may desire to have it framed or suitably mounted, the company has refrained from placing printing of any description on the face of the card.

GENERAL CONTRACTING.—An illustrated bulletin recently received from Frank B. Gilbreth, 34 W. Twenty-sixth St., New York, gives an outline of the principles underlying the "cost-plus-a-fixed-sum" contract, and shows numerous views of contracts already completed. Seventeen illustrations are given of a complete manufacturing town recently built at Sprague Falls, Maine, for the St. Croix Paper Company. The contract included all work necessary to turn a dense forest into a manufacturing town, and to harness the falls to furnish power for lamps and motors for the factories and other buildings. The work included railways and macadamized streets, cottages, private residences, boarding houses, hotels, blocks of stores, machine shops, store houses, railway freight terminals, pulp and paper mills, 2,000-ft. concrete dam, steam, water and electric power plants, etc. The entire town was built in eight months.

REFRIGERATING MACHINERY.—An unusually attractive little mailing card combining the artistic and the practical has just been published by the De La Vergne Machine Company, of New York. The card contains a three-page table of properties of saturated ammonia gas by Prof. De V. Wood, extended by G. Davidson.. The first page bears a half-tone cut of one of the company's standard horizontal refrigerating machines and a line cut of a series of bars the length of which represents the gross tonnage of refrigerating and ice-making machines of the 43 largest builders. The company does not indicate the names of the machines represented by the respective bars with the single exception of the De La Vergne. We understand the cards are for general distribution, so that any one interested in same can obtain a copy of these useful tables upon addressing the De La Vergne Machine Company, foot of East 138th Street, New York City.

News of the Trade

STORE AT LYNN, MASS.—Mr. George C. Smith has taken the Sheehan store, near the monument, and will now carry there a full line of electrical supplies.

M. B. FOSTER ELECTRIC COMPANY, New York City, has been awarded the contract for the outside lighting system at the Central Islip State Hospital, for which bids were opened November 1.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has secured the contract for 30,000 hp of hydraulic machinery to be placed in the first of the nine hydro-electric plants to be built on Catawba River, N. C., for the Southern Power Company.

WESTINGHOUSE IN OHIO.—The increasing business of the Westinghouse Electric & Mfg. Company in the territory covered by its Columbus, Ohio, office has necessitated its moving into larger quarters. After January 15 it will be located in Room 923 Columbus Savings and Trust Building.

THE WAGNER ELECTRIC COMPANY, St. Louis, Mo., at a recent meeting elected Thomas H. West, president of the St. Louis Union Trust Company, a director. He succeeds S. B. Pike, who has removed to Portland, Ore. The directors re-elected are: James Campbell, S. M. Dodd, J. C. Van Blarcom, James W. Bell, Albert Blair and W. A. Layman.

THE BRILLIANT ELECTRIC COMPANY, Cleveland, Ohio, has made arrangements with E. B. Latham Company to represent it exclusively on both types of "Brilliant" lamps in New York City and the vicinity. The sale of these lamps is increasing rapidly and the manufacturer is making arrangements for representative agencies in most of the large cities in this country.

THE NATIONAL ACME MANUFACTURING COMPANY, Cleveland, O., to serve its constantly increasing trade in the Middle and Northwestern States more satisfactorily, has decided to open a warehouse in Chicago at an early date, where a complete stock of set and cap screws and kindred goods will be carried. Exact location will be announced later.

WESTERN ELECTRIC COMPANY, of Chicago, is establishing a branch supply house in Indianapolis, Ind., having recently acquired ownership of the supply department of the Central Union Telephone Company. It has effected a lease of the large building on West Maryland Street, heretofore occupied by the Central Union Telephone Company, where it will carry an extensive stock of electrical supplies.

THE VIADUCT MANUFACTURING COMPANY is pushing its pocket telephone, patented Sept. 19, 1905, as a very convenient outfit for suburban railroads, firemen, line inspectors, and others. This company is also making a new fire alarm box, of recent invention, consisting of a combination watchman's and fire alarm outfit for street purposes or for large establishments. It continues to make district messenger call boxes, and its telephones are known favorably all over the country.

WICKES BROS.—In addition to the general machinery business, heretofore conducted by Wickes Bros., the electrical field will be more actively entered into. They offer for prompt delivery alternating and direct-current machinery of every description suitable for central station work for complete installations. In addition to the offices in New York City, this firm has offices in Boston, Philadelphia, Pittsburg, Chicago and Saginaw.

THE M. B. WHEELER ELECTRIC COMPANY, Grand Rapids, Mich., has secured the contract for the electrical equipment of the Michigan

Plaster Company's plant at Grandville. The installation consists of a 100-hp generator and six large motors, together with the necessary switchboard for controlling the circuits operated by these machines. The work will cost $3,000. The company has also secured the contract for installing an electric plant for the Hackley-Phelps-Bonnell Company, of Hackley, Wis. This will consist of a 15-kw generator, engine and switchboard, and the wiring for 200 incandescent lamps.

NEW YORK TELEPHONE COMPANY, 15 Dey Street, reports an enormous growth of business in 1905, with a net gain of 51,491 stations in the five boroughs, giving a grand total on January 1, 1906, of 242,155 stations in service or under contract. The prospective growth for this year is 75,000 stations, two-thirds of which will be in Manhattan. Last year saw an increase of 35,000 in Manhattan and the Bronx. The opening of the subway also had a marked effect on building operations in the northern part of Manhattan and in the Bronx, and accordingly a large number of apartment houses were planned for and built, most of which provided for a complete system of telephones operated through the popular private branch exchange system—each room being equipped with a telephone. More than 500 apartment houses now have private branch exchange systems providing for over 15,000 telephones. Every hotel in Manhattan of any prominence has a private branch exchange system with a telephone in each room and adequate booths in convenient places for the use of the telephone by the public. More than 160 hotels are thus equipped, containing over 22,000 telephones. During the year four new exchanges were added in Manhattan and a 15-story building represents the new requirements of the general staff at headquarters on Dey and Cortlandt Streets.

ELECTRIC ESCALATORS.—The result of the tabulation of a careful count made at Macy's department store in New York of the handling of customers by elevators and escalators during the recent holiday season adduces some interesting conclusions. During the month of December, up to and including December 24, the escalator at Macy's took on an average, more people away from the first floor than all of the elevators in the entire building and it has always carried many more passengers than the eight elevators which are in its close proximity. When it is considered that the elevators occupy, in the case of the Macy store, for example, 25 times the aisle space and many times the floor space and that the escalator is located in only one spot of the large area while the elevators are distributed on three sides of the store, the tremendous benefit of the escalator to business is obvious. A most noteworthy feature of the handling of the holiday crowd at the great new "Boston Store" in Chicago was the absence of congestion and confusion because the ascending and descending crowds were marshalled by the escalators and never allowed to come into conflict. The escalator is manufactured by the Otis Elevator Company.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., reports that it is turning out steam turbines as rapidly as its present shop facilities will permit, and the huge extensions to its already enormous plant at West Allis have been dictated largely by the necessity of providing more room for this branch of manufacture. Meanwhile orders for reciprocating engines have not ceased to pour in, and the capacity of the company's works is being taxed to the utmost to keep up with the demand for its standard Corliss types. Most of the sales at present, both of turbines and reciprocating engines, include orders for Allis-Chalmers "Bullock" generators to be direct connected to them. The electrical apparatus is now built at the company's works in Cincinnati, but when the new West Allis shops are finished complete power units of all kinds will be constructed there. An interesting equipment was recently shipped from the West Allis, Milwaukee, works of the company, as evidenced by a photograph which has just been received. On a string of flat cars there were loaded the bodies of two steam turbines, each of them occupying not more than one-half the floor space of its car, yet these machines represented in their combined capacity the delivery, under normal conditions, of nearly 5,000 horse-power.

NEW YORK CENTRAL, besides adopting electric locomotion, is modernizing in other respects. The creation of a general advertising department for all the New York Central Lines, and the placing in charge of that department the veteran railroad advertiser, George H. Daniels, who has been for nearly twenty years the General Passenger Agent of the New York Central Railroad, marks an era in the history of advertising in America. The New York Central Lines are the first great system to create an advertising department which covers all the railways in their system, and the far-reaching consequences of such a movement cannot be appreciated at first sight, but this action on the part of the management of these lines emphasizes the value of advertising generally, and forces the conclusion of a strong belief in the efficacy of railroad advertising in particular. Some idea of the importance of this new department can be had when it is understood that it will control the general advertising in America and in foreign countries of the New York Central, Boston and Albany, Lake Shore and Michigan Southern, Michigan Central, Cleveland, Cincinnati, Chicago and St. Louis, Rutland, and Lake Erie and Western railways and their leased lines, having their western terminals at Chicago, St. Louis and Cincinnati and their eastern terminals at New York, Boston and Montreal, and embracing more than twelve thousand miles of the best equipped railways in the world. In this connection it may be mentioned that a banquet to Mr. Daniels by a number of his friends, emphasizing this event, is to be given at the Waldorf-Astoria in February.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JAN. 9, 1906.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N.Y.]

809,300. SWITCH-PLUG WITH ELECTRICAL FUSE; Alexander Hepke and Kurt Diener, Berlin, Germany. App. filed July 20, 1904. A plurality of fuses are rigidly fixed in the plug and electrically connected at one end with one contact. A movable member connects each of the other ends with the other contact, so that when one fuse blows, the circuit may be established through another fuse by turning a disk.

809,301. ELECTRIC MULTIPLE-FUSE PLUG; Alexander Hepke and Kurt Diener, Berlin, Germany. App. filed July 20, 104. The several fuses in the plug are arranged to be used one after the other. The formation of the contacts is controlled from the outside and the cutting in of a new fuse can only be effected when the plug is out of the circuit, the switching ring being then turned to engage the next fuse.

809,302. TRANSFORMER CUT OUT; John P. Heatherington, Logansport, Ind. App. filed Jan. 27, 1905. A system of transformer regulation where a plurality of transformers are employed for varying loads. A magnet-operated switch cuts in or out the various transformers, depending on the amount of the load.

809,305. ELECTRICAL PIANO PLAYER; Pannell B. Kehoe, Flemingsburg, Ky. App. filed Apr. 27, 1905. The piano keys are operated by magnets having sectional windings different numbers of which are energized for each note, depending on the strength required for the particular composition played.

809,309. ELECTROPLATING APPARATUS; Arthur W. L'Hommedieu, Chicago, Ill. App. filed April 22, 1905. Details of construction of a revolving barrel for plating small articles in quantity, with anodes near the surface of the barrel and resident cathodes near the axle. A perforated receptacle of non-conducting material prevents the articles to be plated from making contact with the anode.

809,311. FIREPROOF WIRE; Amanda M. Lougee, Boston, Mass. App. filed Nov. 5, 1903. An armor conduit containing a conductor covered with an insulating, fireproof, moisture-proof compound and capable of internal and external use in all positions heretofore requiring the usual lead or iron pipe in which the insulated wire is inserted.

809,312. PROCESS OF MAKING FIREPROOF CONDUCTORS; Amanda M. Lougee, Boston, Mass. App. filed May 23, 1904. The wire is first coated with an insulating compound and surrounded with a fireproof jacket about which is a plastic layer of fireproof and vulcanizable ingredients, in the outer surface of which is embedded a wire covering having a coating of special materials which form a part of the covering. A second or third covering of wire and coating are then applied and the whole vulcanized and rendered as nearly integral and homogeneous as possible.

809,313. PROTECTED CONDUCTOR; Amanda M. Lougee, Boston, Mass. App. filed May 23, 1904. The conductor is enveloped in a vulcanizable compound over which is tightly woven a wire jacket having a vulcanizable fireproofing and insulating compound incorporated with it and penerating the meshes. The whole is covered by a thick external coating of permanently flexible compound containing ingredients to render it moisture, electrolysis and fireproof, and vulcanized together as a one-piece article.

809,394. ELECTRICALLY OPERATED PORTABLE DRILL; Adolph Pedersen, Cleveland, O.. App. filed Sept. 19, 1904. Details of the driving mechanism, employing a motor having its armature supported in ball bearings in alignment with the drill axis, and having a plurality of back gears to properly reduce the speed.

809,433. ROTARY ELECTRIC SWITCH; John Dugdill, Failsworth, Manchester, England. Mar. 15, 1905. Adapted to hanging incandescent lamps. The lamp cord depends from a spring drum and the switch blades are so related to said drum as to be closed when the cord is pulled down, and opened when it is released to be drawn upward.

809,460. MOTOR CONTROLLER; Adolph Pedersen, Cleveland, O. App. filed May 26, 1905. A cut-out magnet is applied to one of the pole pieces of the motor of an electric drill, and mounted in a special way on the flux, corresponding to abnormal current.

809,492. PROCESS OF ELECTROLYTIC PRODUCTION OF LUSTROUS METALLIC COATINGS UPON METALS; Alexander Classen, Aachen, Germany. App. filed Sept. 28, 1905. Lustrous metallic coating are produced directly by electrolysis, by adding one or more glucosides to an ordinary electroplating bath.

809,515. ELECTRICAL RAILWAY SIGNALING SYSTEM; Milton H. Loudon, Kansas City, Mo. App. filed June 29, 1905. The railroad is equipped with a special trolley in circuit with signal devices on all the trains. The section between trains forms one arm of a Wheatstone bridge, the varying resistance of which is effective to first display a lamp, and finally set the brakes within the locomotive cabs.

809,529. ELECTRIC LAUNDRY IRON; Earl H. Richardson, Ontario, Cal. App. filed Apr. 25, 1905. The laundry iron has a pair of cores therein each of which extend from the point to a rear end or corner. The cores are wound with resistance wires throughout their lengths, the purpose being to secure a uniform distribution of the heat.

809,595. BELL PUSH, PULL, ETC.; Lawrence S. Wilks, Whipps Cross, England. App. filed May 1, 1905. A push botton is made of glass and is located at the end of a projecting knob through which the light passes from the interior of the building and illuminates the push button so that its location may be readily discerned.

809,630. TROLLEY ATTACHMENT; Edward D. Rockwell, Bristol, Conn. App. filed May 17, 1905. In order to avoid crippling a car by the breakage of its trolley wheel, the patentee aims to provide each car with a fork attachment which can be inserted into the place of the broken wheel and serve sufficiently well to carry the car to the repair barn.

809,643. MEANS FOR CONTROLLING MERCURY VAPOR ELECTRIC LAMPS; Percy H. Thomas, East Orange, N. J. App. filed Apr. 23, 1904. An electric lamp and an iron wire in a hydrogen atmosphere are included in series with the vapor lamp so as to give a high starting resistance, and a steadying resistance during the operation of the lamp.

809,647. ELECTRIC CELL; Kumajiro Tsukamoto, Tokyo, Japan. App. filed Jan. 14, 1904. A primary cell with a cylindrical zinc casing and a hollow carbon tube, covered with blotting paper and filled with a mixture of graphite, manganese dioxide, potassium chloride, potassium permanganate and ammonium chloride. The space between carbon tube and zinc casing is filled with a mixture of ammonium chloride, potassium chloride, gypsum, mercuric sulphate, and dextrine.

809,677. STARTING-COMPENSATOR FOR ALTERNATING-CURRENT MOTORS; Edward F. Gehrkens, Schenectady, N. Y. App. filed June

24, 1904. A switch is provided for use in connection with an auto-transformer and circuit fuses, so that in starting the motor the auto-transformer will be in circuit and the fuses cut out, but in the running position the auto-transformer is cut out and the fuses are in circuit.

809,693. MECHANICAL MOVEMENT; Gray W. Johnston, New York, N. Y. App. filed March 27, 1905. The switch is adapted to close different circuits alternately upon the energization of a magnet, periodically energized from any suitable source. The switch is applicable, among other uses, to the operating of a track switch in which it is necessary to move the switch point alternately by successive currents from the same trolley circuit. Construction embodies a link depending from the solenoid core and working in a V-shaped cam groove upon the switch arm.

809,700. THERMOSTATIC SWITCH FOR INCANDESCENT ELECTRIC LAMPS; John V. Kimmey, Jr., New Haven, Conn. App. filed April 1, 1905. One side of the circuit is completed through a bowed plate of metal rigidly fixed at both ends and having wound around it material offering resistance to the passage of current. Electrical contact is made between the center of the bow and a pin connected in the lamp circuit. The expansion of the bowed plate, owing to the passage of current, breaks the contact, which is again made when the metal contracts, giving the light a twinkling effect.

809,706. ELECTRIC ALTERNATING-CURRENT MACHINE; Karl Arvid Lindstrom, Vesteras, Sweden. App. filed June 29, 1905. The windings are so placed mechanically on the armature that the harmonics generated in the sine wave of e.m.f. under one pole are displaced practically half a period in relation to the corresponding harmonics generated at the other pole, so that they neutralize each other.

809,707. PNEUMATIC TRAIN CONTROL SYSTEM; John B. Linn, Schenectady, N. Y. App. filed Oct. 16, 1902. A spring-pressed piston is moved varying distances within each car by the train pipe pressure which serves to successively uncover ports in the side walls which lead to the successive pneumatically operated contactors.

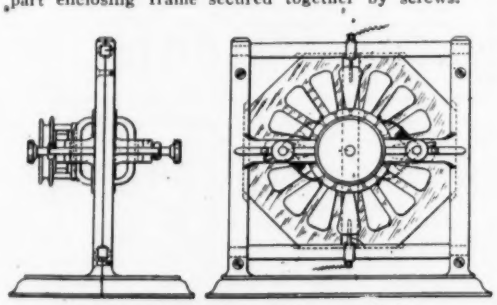
809,728. ELECTRICAL HEATING SYSTEM; Arthur D. Newton, Hartford, Conn. App. filed July 9, 1904. The heaters are included in a circuit which is automatically opened by a cut-out magnet in case an unusually heavy load is imposed upon the motors.

809,742. STORAGE-BATTERY PLATE; David P. Perry, Chicago, Ill. App. filed June 8, 1903. The grid consists of three flat superimposed lead plates, perforated and cut in a certain way so as to form pockets for the active material.

809,743. CROSS-ARM FOR CARRYING HIGH-TENSION WIRES; Evan E. P. Petery, Indianapolis, Ind. App. filed Aug. 19, 1904. The cross arm is of the usual shape, but made of glass and integral with the insulators so as to give greater insulation.

809,747. HANGER OR EAR FOR OVERHEAD ELECTRIC TROLLEY WIRES; Abraham Richardson and Thomas S. Jones, Blackpool, England. App. filed Feb. 6, 1905. The hanger has two halves which clamp the wire and are held together by an engaging ferrule or cup, depending from the guy-wire support.

809,761. ELECTROSTATIC INFLUENCE MACHINE; Elihu Thomson, Swampscott, Mass. App. filed June 23, 1904. Mechanical features of construction of electrostatic machine having Wimshurst sectors. The two stationary plates are octagonal and are held by a two-part enclosing frame secured together by screws.



809,761.—Electrostatic Influence Machine.

809,762. TELAUTOGRAPHIC AND OTHER ELECTRIC CIRCUITS; George S. Tiffany, New York, N. Y. App. filed Apr. 22, 1901. A complete telautograph system in which alternating currents are used, but which are obtained from a direct-currrent source. The purpose is to secure reversals in the movement of the stylus by reversing currents, at the same time utilizing the ordinary current mains for obtaining the power.

809,770. ASYMMETRIC CELL; Max Büttner, Wilmersdorf-Berlin, Germany. App. filed Aug. 4, 1904. An aluminium electrode is used as electrolytic valve with an electrolyte, consisting of a solution of caustic ammonia and boric acid.

809,774. SYSTEM OF CONTROL; Frank E. Case, Schenectady, N. Y. App. filed June 12, 1905. A feature of a special pneumatic train control system by which a circuit breaker in the motor circuit is opened upon the exhaustion of the pneumatic system when the motor circuit remains energized, but not when the motor circuit is de-energized. The idea is to have the circuit breaker tripped in case of overload, but not with the usual movements of the controller arm. Special features for utilizing the motors as a magnetic brake are also provided.

809,773. EMERGENCY OPERATING MEANS FOR REVERSING SWITCHES; Frank E. Case, Schenectady, N. Y. App. filed Aug. 23, 1904. Each car has mechanical connections from both platforms to a single switch beneath the car and in the motor circuit by which the motors are arranged in closed circuits including the series fields in a direction to build up the same and generate current. The purpose is to obtain a magnetic brake in case the power fails and the usual air brakes do not operate.

809,782. COMBINED CIGAR CUTTER AND LIGHTER; William H. Crawford, Cliftonforge, Va. App. filed May 11, 1905. The cutter has connections with an arm by which the arm is moved whenever a cigar is inserted into the cutter. The arm carries the usual wick and electric igniter so that a flame is automatically provided whenever the end of the cigar is cut off.

809,787. ALTERNATING-CURRENT MOTOR; Max Deri, Vienna, Austria-Hungary. App. filed May 2, 1904. The motor operates as a single-phase induction motor, but starts from rest as a series motor. The rotor winding is short circuited at a number of points indivisible by the number of poles of the motor, so that it acts as a short-circuited secondary when full speed is reached.

809,793. ELECTROSTATIC VOLTMETER; James Ferguson, Glasgow, Scotland. App. filed Mar. 29, 1904. A form of quadrant electrometer of portable form. The interior of the case has an insulating coating which in turn has a conducting coating within it. The usual fixed cells of the electrometer are connected to this conducting coating.

809,794. RAILROAD SYSTEM; Hannibal C. Ford, Jamaica, N. Y. App. filed Sept. 12, 1905. A train control system in which a train is automatically stopped in case an engineer passes a caution signal above a certain speed.

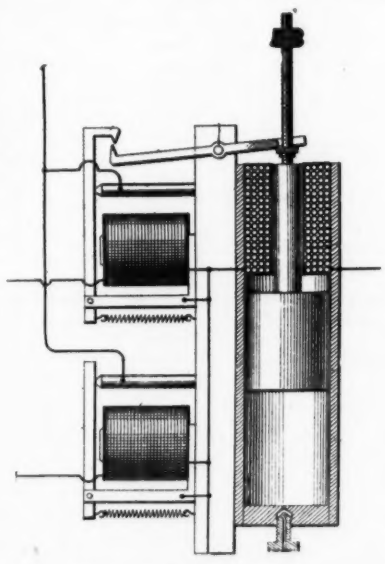
809,798. MEANS FOR CONTROLLING OVERHEAD ELECTRIC CARRIERS; Henry M. Harding, New York, N. Y. App. filed Apr. 21, 1902. The main portions of the telpher line are constantly charged to the full working potential, but at the stations the telpher system has a low potential so that the cars automatically stop thereat when they are loaded by reason of insufficient power to operate the motors. When the cars are empty, however, the power is sufficient to operate the motors to propel the cars onward. The station parts of the line may be charged to the full potential when desired to move a loaded car thereat, or for any other purpose.

809,825. ELECTRIC METER; William J. Lloyd, Pittsfield, Mass. App. filed May 10, 1904. An induction watt-hour meter of substantially the ordinary form having a rotary disc, a current coil and potential coils which act thereon at the usual 90° phase separation. Auxiliary current coils are, however, provided for minutely adjusting the phase relation. The damping magnet is specially arranged so that its flux threads the disc twice.

809,835. ALTERNATING-CURRENT MACHINERY; Addams S. McAllister, New York, N. Y. App. filed March 2, 1905. A non-inductive resistance is placed in shunt to the field coils of a single-phase commutator motor for the purpose of causing the field magnetism to lag behind the armature current so that the electromotive force counter generated at the armature will likewise lag behind the armature current. Under the speed conditions, the armature current tends to lead the circuit e.m.f. and thus improves the power factor.

809,837. FUSE-PLUG; Henry T. Paiste, Philadelphia, Pa. App. filed Nov. 23, 1904. In permanent electrical connection with the terminals of the plug are spring clips designed for holding the ordinary cartridge fuse.

809,842. APPARATUS FOR THE PRODUCTION OF CALCIUM CARBIDE; Edgar F. Price, George E. Cox and James G. Marshall, Niagara Falls, N. Y. App. filed Oct. 19, 1904. For electrodes in calcium carbide furnaces graphite rods are used of reduced cross-section and length, to offset the greater cost of the graphite. The rods are mechanically strengthened and protected from oxidation by a re-inforcing body of cement. The electrode-holders and sockets are water-cooled.

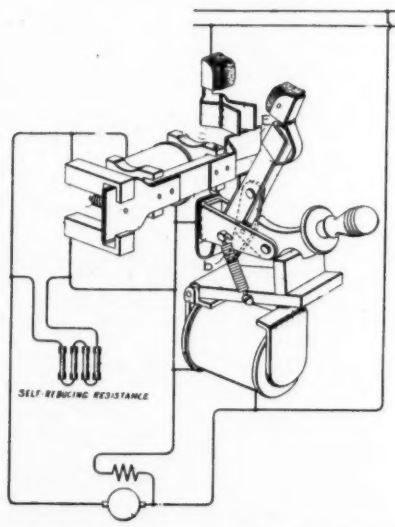


809,794.—Railroad system.

809,864. INSULATED RECEPTACLE FOR PANEL AND SWITCHBOARDS; William C. Tregoning, Plainville, Conn. App. filed Feb. 18, 1905. The arrangement of the several parts of the receptacle is such that it may be assembled piece by piece upon the front face of the switchboard, and after the metallic parts forming the contacts are in place the insulating casing may be put in place and securely locked.

809,873. PANEL CUT-OUT AND RECEPTACLE; Frank T. Wheeler, Plainville, Conn. App. filed Feb. 18, 1905. The contact members are connected with the circuit terminals and removably secured to the base. An insulating sleeve surrounds the threaded sleeve contact, and the former may be readily replaced without disturbing the metallic parts of the receptacle.

809,878. STARTING DEVICE FOR ELECTRIC MOTORS; Howard B. Wilson, Schenectady, N. Y. App. filed Mar. 10, 1904. Magnetite tubes are included in series with the motor circuit so as to provide a starting resistance which diminishes as the magnetite becomes heated. When the potential drop across the magnetite has fallen to a certain amount it is automatically cut out by a magnetic device so as not to absorb power from the circuit.



809,878.—Starting Device for Electric Motors.

809,904. EMERGENCY ELECTRIC-LIGHTING ARRANGEMENT FOR THEATRES AND SIMILAR BUILDINGS; Fritz Brand, Berlin, Germany. App. filed March 21, 1905. Lamp groups on the different floors and galleries are fed from batteries in the cellar through leads vertically arranged, each circuit being independent of the other. Each battery is situated as nearly as possible directly underneath the lamp groups supplied by it and is protected by the cellar walls and by fire-proof covers.

809,908. SYSTEM OF CONTROL; Frank E. Case, Schenectady, N. Y. App. filed Oct. 1, 1904. A complete pneumatic multiple train-control system having two train pipes. Controllers upon each car are similar in appearance to the ordinary engineer's valve.

809,917. ELECTRIC HEATER FOR OIL WELLS AND METHOD OF MAKING SAME; Benjamin F. Gardner, Chicago, Ill. App. filed Apr. 5, 1904. A cylindrical iron frame has a rubber composition coating, including asbestos, in which the heating coil is embedded.